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12. ABSTRACT (Maximum 200 words)

The conference objectives were: Provide a forum for representatives from governments, international maritime and harbour authorities, ship owners, industry and academia to exchange information on the latest maritime environmental technologies concerning solid waste treatment for all ship sizes; Discuss national and international IMO compliance; Discuss current requirements and trends for future maritime pollution abatement standards; Present and discuss advanced solid waste technologies, future research and adaptation of current and future technologies for shipboard and harbour applications. The conference was organized in four sessions: Session 1 – Solid Waste Treatment Policies; Session 2 – Thermal Waste Water Treatment Technologies; Session 3 – Mechanical Waste Treatment Technologies; Session 4 – System Engineering for Waste Water Treatment on Ships.

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Maritime Conferences

• The Maritime Environment •

International Conference and Exhibition

"Solid Waste Treatment Technologies for Ships"

The Conference is sponsored by:

DEERBERG SYSTEMS

21st – 23rd April 1999
Crowne Plaza Hotel
Antwerp, Belgium

CONFERENCE PROCEEDINGS

SOLID WASTE TREATMENT TECHNOLOGIES FOR SHIPS

International Conference and Exhibition sponsored by the

United States Navy
Office of Naval Research Europe
and
DEERBERG SYSTEMS

on 21st – 23rd April 1999
at the
Crowne Plaza Hotel
Antwerp, Belgium

organized by

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• The Maritime Environment •
International Conference and Exhibition

"Solid Waste Treatment Technologies for Ships"

Table of Contents

Summary of the Conference on SOLID WASTE TREATMENT TECHNOLOGIES FOR SHIPS in Antwerp, Belgium on 21 – 23 April 1999

The International Conference on "Solid Waste Treatment Technologies for Ships" was held on 21st – 23rd April 1999 in the Crowne Plaza Hotel in Antwerp, Belgium.

The Conference had been initiated and was organised by Eule & Partners International Consulting SPRL, Tervuren, Belgium.

The Conference was sponsored by the US Office of Naval Research Europe (ONR Europe) in London, UK and DEERBERG-SYSTEMS in Oldenburg, GE.

ONR Europe is committed to fostering and facilitating collaboration in Science, Technology, Research and Development between the United States and their professional counterparts in Europe, Africa and the Middle East. ONR Europe liases with international scientists and engineers through conferences, workshops, visits and personal research to identify key opportunities in S&T, to assess S&T activities and accomplishments and to exchange information and ideas in areas of mutual interest.
ONR Europe is based in London.

In the world of maritime application of waste management systems DEERBERG-SYSTEMS is a well-known company and the worldwide leading supplier for Total Waste Management Systems for the Cruise Line Industry. Up to now DEERBERG-SYSTEMS has been supplying 98 systems to large passenger vessels. Mr. Deerberg hosted the dinner on the first evening.

The Conference objectives were to:

- Provide a forum for representatives from governments, international maritime and harbour authorities, ship owners, industry and academia to exchange information on the latest maritime environmental technologies concerning solid waste treatment for all ship sizes.
- Discuss national and international policies and regulations for IMO compliance.
- Discuss current requirements and trends for future maritime pollution abatement standards.
- Present and discuss advanced solid waste treatment technologies, future research and adaptation of current and future technologies for ship systems.
- Devise recommendations for latest technology for shipboard and harbour applications.
- Provide recommendations to industries and governments for policies and international collaboration.
- Exhibit solid waste technologies applicable to ship board employment.

50 Experts in this area from 11 different Nations (Belgium, France, Finland, Germany, Greece, Italy, Netherlands, Norway, Sweden, the United Kingdom and the United States) attended the conference. They represented the whole range of interested groups in this field, i.e. Cruise Lines and Shipping Industry, Shipyards, Navies, System Engineering Companies, Equipment Manufacturers and Regulation Authorities.

The Conference was organized in four Sessions:

Session 1 – **Solid Waste Treatment Policies**
Session Chairman Dr. Igor Vodyanoy, ONR Europe, US

Session 2 – **Thermal Waste Water Treatment Technologies**
Session Chairman Mr. Claus Altenberg, DEERBERG-SYSTEMS, GE

Session 3 – **Mechanical Waste Treatment Technologies**
Session Chairman Mr. Joel Krinsky, US Navy, US

Session 4 – **System Engineering for Waste Water Treatment on Ships**
Session Chairwoman, Mrs. Denise Oakley, AEA Technology, UK

The keynote address was presented on behalf of the General Manager of the Antwerp Harbour Authorities Mr. Eddy Bruxyninckx by Mr. Guido de Meel.

The Session Chairpersons provided an introductory paper in their respective areas before the Speakers from Governments and Industry presented the papers on their different subjects.

The guiding principles for all presentations during the conference were "Compliance with IMO Regulations".

Compliance is largely driven by legislation, i.e. the implementation of the MARPOL Annexes by more and more nations, new IMO regulations, emerging EU directives, declaration of Special Sea Areas and more stringent port regulations.

Coordinated control of compliance by the port authorities will become more stringent and fines and fees will result in non-compliance.

Waste treatment aboard the vessels at sea has become more attractive because of the increasing cost of shore disposal of shipboard waste.

There have been significant advances in technology concerning thermal treatment, mechanical devices and total waste management systems. All of these will be able to reduce the amount of waste to be disposed and also reduce cost due to the residues of treated waste being more benign and thus creating less treatment requirements in port.

Maintenance of freedom of operations which so far has more been a determining factor for Naval vessels is now increasingly important as ports may deny access for cargo and passenger vessels if they do not comply with the regulations.

Another driving factor is Public Image. The shipping industry depends on it in a way that non-compliance will increase political pressure by the public for further tightening of rules and surveillance, i.e. increase of cost for the shipping industry.

Overall the conference provided very interesting papers and discussion amongst the participating experts and covered a good range of applicable technologies and equipment, and the conference

participants have learned much about the capabilities of the manufacturers as well as the requirements of the customers.

The exhibitions by DEERBERG-SYSTEMS, RETECH Systems Inc., Scanship Engineering and Taifun Oy have helped visualising the systems, technologies and products addressed during the conference. As a historical reference Eule & Partners had placed an exhibit from the Maritime Museum in Flensburg, Germany, on "Human Waste Disposal in the Old Days".

Organizationally and socially the conference worked well. The Crowne Plaza Hotel in Antwerp offered very good conference facilities and support.

The conference was extensively used by the participants to conduct business discussions.

The social events, the luncheons, the reception hosted by the Organizer and the dinner hosted by DEERBERG-SYSTEMS offered many additional opportunities for discussions amongst the delegates.

In summary the conference was received very well by the Participants, who expressed their desire, to participate in future conferences in the area of environmental technologies for ships and other maritime applications.

• The Maritime Environment •

"Solid Waste Treatment Technologies for Ships"

Objectives of the Conference

Conference Objectives

- Provide a forum for representatives from governments, international maritime and harbour authorities, ship owners, industry and academia to exchange information on the latest maritime environmental technologies concerning solid waste treatment for all ship sizes.
- Discuss national and international policies and regulations for IMO compliance.
- Discuss current requirements and trends for future maritime pollution abatement standards.
- Present and discuss advanced solid waste treatment technologies, future research and adaptation of current and future technologies for ship systems.
- Devise recommendations for latest technology for shipboard and harbour applications.
- Provide recommendations to industries and governments for policies and international collaboration.
- Exhibition of solid waste technologies applicable to ship board employment.

Organisation

Sessions will consist of an introductory and technical overview talk by the Session Chairman and 20 to 40 min (+ 5 min questions) technical papers; there will be 30 minutes general discussion at the end of each session.

The Conference is sponsored by:

UNITED STATES NAVY OUR EUROPE

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• The Maritime Environment •
"Solid Waste Treatment Technologies for Ships"
Conference Schedule

Wednesday, 21st April 1999

Time	Event
09.30h – 10.30h	**Check in, Welcome Coffee**
10.30h – 10.35h	**Welcome and Introduction** *Mr. Klaus Eule*, Eule & Partners, BE
10.35h – 10.45h	**Keynote Address** *Mr. Eddy Bruyninckx*, General Director, Antwerp Port Authority, BE read by *Mr. Guido van Meel*

Session 1 – Solid Waste Treatment Policies

Time	Event
10.45h – 11.30h	Paper 1 on **IMO Solid Waste Treatment Requirements** *Session Chairman Dr. Igor Vodyanoy,* ONREUR, USN
11.30h – 12.15h	Paper 2 on **Maritime Aspects of NATO Environmental Policies and Activities** *Capt (ITN) Arcangelo Simi,* NATO IS DS Nav. ARMTS, BE
12.15h – 12.20h	Administration *Mr. Karl M. Scheuch,* Eule & Partners, GE
12.30h – 14.00h	**Luncheon** **LUNCHEON SPEAKER: "Antwerp, a Sparkling Diamond"** *Mrs. Annik Boogaert,* Tourist Office Antwerp, BE

14.00h – 14.45h	Paper 3 on **U.S. Navy Solid Waste Requirements – Past, Present, and Future** *Mr. Joel Krinsky,* NAVSEA, USN
14.45h – 15.15h	Paper 4 on **Solid Waste Requirements Resulting from the European Draft Directive on Shore Reception Facilities** *Mr. Guido van Meel,* Antwerp Port Authority, BE
15.15h – 15.45h	**Coffee Break**
15.45h – 16.30h	Paper 5 on **Solid Waste Treatment on Cruise Line Ships – IMO vs. U.S. and Caribbean Port Authorities Requirements** *Mr. Albert Garcia,* Carnival Cruise Lines, USA
16.30h – 17.15h	Paper 6 on **To be disposed or not to be disposed** *Mr. Cornelius de Keyzer,* Rotterdam Municipal Port Management, NL
17.15h – 17.45h	**Discussion and Conclusion Session 1**
18.30h – 19.30h	**Reception (hosted by Eule & Partners)**
19.30h	**Hosted Dinner by DEERBERG-SYSTEMS**

Thursday, 22nd April 1999

Time	Event

Session 2 – Thermal Waste Treatment Technologies

09.00h – 09.45h	Paper 1 on **Thermal Waste Treatment – Yesterday, Today, Tomorrow** *Session Chairman Mr. Claus Altenberg,* Consultant, GE
09.45h – 10.30h	Paper 2 on **Development of a Plasma Arc System for the Destruction of U.S. Department of Defence Hazardous Waste** *Mr. Dr. Richard C. Eschenbach,* RETECH Services, US
10.30h – 11.00h	**Coffee Break**
11.00h – 11.45h	Paper 3 on **Waste Management Technology aboard Ships using Advanced Incinerator Technology** *Mr. Jøgen Kyed,* TeamTech, NO Highlights presented by *Dr. Igor Vodyanoy*
11.45h – 12.30h	Paper 4 on **Facilities for Women at Sea – Development of an Onboard Treatment System for Female Sanitary Waste** *Mr. Howard M. Clarke,* Morgan Automation, UK

12.30h – 14.00h	**Luncheon**
14.00h – 14.30h	**Discussion and Conclusion Session 2**

Session 3 – Mechanical Waste Treatment Technologies

Time	Event
14.30h – 15.15h	Paper 1 on **Food Waste Management System Taifun** *Session Chairman Mr. Maarten Bärlund,* Taifun Oy, FI
15.15h – 16.00h	Paper 2 on **U.S.Navy Solid Waste Equipment Program** *Mr. Peter McCraw,* NSWC CD, USN presented by *Mr. Joel Krinsky*
16.00h – 16.30h	**Coffee Break**
16.30h – 17.15h	Paper 3 on **Dry Waste Management Making Use of Shredder, Glass Crusher, Compactor, and Chute Systems** *Mr. Uwe Wittkamp,* Lindau Entsorgungs GmbH, GE
17.15h – 17.45h	Paper 4 on **Waste Management Utilising Pulpers and Water-Press** *Mr. Wolfgang Zillgith,* Lindau Entsorgungs GmbH, GE Read by *Mr. Jochen Deerberg*
17.45h – 18.15h	**Discussion and Conclusion Session 3**

Friday, 23rd April 1999

Session 4 – System Engineering for Waste Treatment on Ships

Time	Event
09.00h – 09.45h	Paper 1 on **Integrated Waste Management Systems for Future Ship Design** *Session Chairwoman Mrs. Denise Oakley,* AEA Technology, UK
09.45h – 10.30h	Paper 2 on **Evolution of Waste Management** *Mr. Olle Lundberg,* USON Marine, SE
10.30h – 11.00h	**Coffee Break**
11.00h – 11.45h	Paper 3 on **Multi Purpose Waste Management System** *Mr. Jochen Deerberg,* DEERBERG SYSTEMS, GE

11.45h – 12.15h	**Discussion and Conclusion Session 4**
12.15h –12.30h	**Conference Conclusion** *Mr. Klaus Eule*, Eule & Partners, BE
12.30h –14.00h	**Luncheon**
14.00h	**Departure**

Conference Proceedings are included in the Conference Fees and will be delivered as CD-ROM. Conference Proceedings can also be obtained as hard copies at an additional cost of US $ 100 each.

Welcome Address by the Conference Organizer, Mr. Klaus D. Eule, to the Conference on "Solid Waste Treatment Technologies for Ships"

Ladies and Gentlemen!

I would like to extend a special welcome to our Sponsors, the US Navy Office of Naval Research Europe, represented here by its Associate Director Dr. Igor Vodyanoy from London and the Oldenburg based Waste Management Systems company DEERBERG-SYSTEMS, represented by its CEO Jochen Deerberg.

ONR Europe is committed to fostering and facilitating collaboration in Science, Technology, Research and Development between the United States and their professional counterparts in Europe, Africa and the Middle East. ONR Europe liases with international scientists and engineers through conferences, workshops, visits and personal research to identify key opportunities in Science and Technology, to assess Science and Technology activities and accomplishments and to exchange information and ideas in areas of mutual interest. ONR Europe is based in London.

In the world of maritime application of waste management systems DEERBERG-SYSTEMS is a well known company and the world-wide leading supplier for Total Waste Management Systems for the Cruise Line Industry. DEERBERG-SYSTEMS now has been supplying 100 systems to large passenger vessels. Mr. Deerberg will host our dinner tonight after our reception.

During lunch we will have Mrs Annik Boogaert from the Tourist Office in Antwerp, who will give us some insider advice on this beautiful city of Antwerp.

As usual in a busy environment we have some last minute modifications to the Agenda because of business or personal conflicts, e.g. we regret that Jorgen Kyed from Team Tech has become ill and therefore could not present his paper personally. However Dr. Vodyanoy has offered to present the paper on the Advanced Incinerator Technology with the Afterburner Integration on his behalf.

I would also like to draw your attention to the exhibition of products by DEERBERG-SYSTEMS, Retech, Scanship and Taifun Oy outside in the hall. I recommend that you take the opportunity to get yourself informed on the products and visit the stands. As a particular highlight and for your endearment we have brought some exhibits from the Maritime Museum in Flensburg on "Solid" Human Waste Disposal.

Finally, I would like to introduce to you our Conference Team, who the one or the other of you have already met or talked to on the telephone:
Mr. Karl Scheuch, our Director Conferences,
Mrs. Elke Lonicer, our Conference Manager and
All of us will be available to you during this conference and assist you in any matters, where you feel, that we could be of help. So, please do not hesitate to call on us for assistance.

Before we break for lunch today, Karl Scheuch will brief you on some administrative details and will clarify any questions you may have on the organization and proceedings of our conference

With this I will conclude my opening remarks and introduce Mr. Guido de Meel from the Antwerp Harbour Authorities, who will present the keynote address on behalf of Mr. Eddy Bruyninckx, the General Director of the Antwerp Harbour Authorities.

Eddy Bruyninckx
Biography

Graduated from St. Michielscollege, Brasschaat University in 1996

Graduated from University Faculties Sint Ignatius Antwerp in Candidature Political and Social Sciences in 1973

Career:

- Assistant University Faculties Sint Ignatius (1974–1977)
- Inspector Ministry of Finance. First Laureate of the 12^{th} promotion (1977–1980)
- Advisor Cabinet of Mrs. R. de Backer-Van Ocken, President of the Flemish Govmt (1980-1981)
- Deputy principal private secretary of Mr. Geens, President of the Flemish Govmt (1981-1986)
- Secretary General of the Social Economic Council of Flandres (1987-1991)
- Principal private secretary of Mr. Geens, President of the Flemish Govmt (1991)
- From 1.2.1992 General Manager of the Port of Antwerp
- From 1.1.1997 Chief Executive Officer of the Antwerp Municipal Port Authority

Speech of Eddy Bruyninckx, Chief Executive Officer of the Antwerp Port Authority on the occasion of the opening of the international Conference and Exhibition on "Solid Waste Treatment Technologies for ships"

Mister chairman,
Ladies and gentlemen,

I am very pleased and honoured to welcome you at the opening of the international conference on solid waste treatment technologies for ships.

The prevention of pollution in order to protect and preserve the marine environment is one of the great tasks of our times. It is not only a moral obligation, but states are also legally obliged to comply with the UN Convention on the Law of the Sea of 1982, including specific regulations on pollution prevention.

It is nevertheless generally recognised that the actual level of discharges at sea of waste and cargo residues from ships is unacceptable. It is equally recognised that the reasons for this have to be sought both on board of ships, due to ignorance of the crew, and on shore, due to inadequate reception facilities.

The necessity of a dual approach was therefore recognised in the International Convention for the prevention of Pollution from ships, 1973 and, the related Protocol of 1978 (better known under the name MARPOL 73/78).

The discrepancy between existing rules and prevalent practice was acknowledged by the Commission in its communication 'A common Policy on Safe Seas of 1993' which stated that an improved compliance with the requirements of MARPOL 73/78 and further initiatives to improve implementation of international rules and standards are required.

It may seem odd that given the international character of shipping and the global basis of international regulations, the EU wants to improve the marine environment with regional initiatives. However, when analysing the European Treaties it becomes clear that the European Union and its policies are no longer purely economically oriented. Both the Single European Act of 1986 and the Maastricht Treaty of 1992 widened the scope of the Treaty of Rome, adding new fields of interest to its initial economic concerns, such as environmental protection, research and technological development, public health and consumer protection.

The Maastricht Treaty added a specific safety paragraph in Article 75 of the E C Treaty, which nowadays allows the Commission to present today proposals which are essentially safety – oriented or aimed at better environmental protection.

Consequently, in March 1996, the Commission developed and presented its views on European Shipping in another Communication, "Towards A New Maritime Strategy" in which a chapter devoted to safety issues re-iterates and updates the basic principles set out in the 1993 Communication. Also in the Green Paper (1998) several paragraphs on safety and environment are included. These recent developments clearly illustrate the objective of the Commission to ensure effective and uniform compliance of all ships entering EU ports with international legislation related to ship/port interface, including cargo-handling, technical-nautical services, and protection of workers involved in cargo operations.

Furthermore the Commission stresses the importance of ensuring that environment friendly solutions are applied both in the port sector and at sea. This implies for instance the enhancing of the availability and adequacy of reception facilities in all EU Ports.

I also refer to other initiatives of the Commission related to the topics :

the "Hazmat-directive" imposes an obligation on all masters or operators of ships carrying dangerous or polluting goods to report the details of their cargoes, to a competent authority when bound for or leaving an EU port;

the so called "SBT-directive" in which the commission has made the IMO-Resolution A.747 mandatory in the EU in order to promote the use of environmental friendly SBT's in European waters,

the launching by the Commission in 1994 of common rules for a ship's inspection and survey organisations and for the relevant activities of maritime administrations;

the focus of the Commission on the human element as a cause of accidents by marking the implementation of the STCW Convention as a priority;

the Port State Control Directive (1996), one of the centrepieces of the EU policy because of its focus on control;

the rules the EU developed for Ro Ro ferries and for passenger vessels.

One of latest initiatives of the Commission is the proposal for a council directive on port reception facilities for ship-generated waste and cargo residues. With this proposal the Commission intends to promote the mandatory use of Marpol reception facilities.

All these initiatives seem to stimulate IMO's MEPC to launch new rules as well. Nowadays proposals are tabled on the reduction of air pollution from seagoing vessels and on tackling the problem of unwanted aquatic organisms in clean ballast water.

Ladies and gentlemen,

This overview of directives and other international rules illustrate the growing importance which is being allocated to the safety and environmental aspects of shipping by both the IMO and the European Commission.

I hope that the outcome of this conference, which is focussing on new technologies for reduction of ship waste, will contribute to a further improvement of the marine environment. The final goal must be to provide new and better solutions which, can be implemented at acceptable prices, in order to keep maritime transport an attractive and environment friendly means of transport. —— Thank you.

• The Maritime Environment •

"Solid Waste Treatment Technologies for Ships"

Session 1

Solid Waste Treatment Policies

Session Chairman: Dr. Igor Vodyanoy, U.S. Navy Office Naval Research Europe, UK

Session 1– Solid Waste Treatment Policies

Session Chairman:
Dr. Igor Vodyanoy is the Chief of the Office of Naval Research Europe of the Department of the Navy in London, UK.

He graduated from St. Petersburg Polytechnic Institute 1971.
He subsequently graduated from the Institute of Cytology at the Academy of Seienees 1975.
He was on the faculty of the University of California, Irvine, US, 1978 – 1988.
He is at the Office of Naval Research, London, since 1988 and on the faculty of the Imperial College, London, since 1994.

He is one of the Sponsors of this conference.

Dr. Vodyanoy will now take the chair for session 1 and present his lead in paper on

IMO Solid Waste Treatment Requirements

Paper 2: Capt (ITN ret.) Arcangelo Simi, NATO HQ

Ladies and Gentlemen I like to introduce Capt (ITN ret.) Arcangelo Simi.
Capt Simi is the Head of the Naval Armaments Section and EW Coordinator within the Defence Support Division of the International Staff in NATO Headquarters, Brussels.

He retired from the Italian Navy after 28 years, 14 of which were as sea on board of several ships. He attended the NATO Defence College, served in SHAPE, where he prompted the MEWSG, and achieved an advanced qualification in Communications and Electronic Engineering.

His present responsibility is mainly to foster international cooperation in naval armaments and providing technical advice within the Secretary General's Staff.

He will now present a paper on

Maritime Aspects of NATO Environmental Policies and Activities

Paper 3: Joel Krinsky, Naval Sea Systems Command, US

I like to introduce Mr. Joel Krinsky from Naval Sea Systems Command, US Department of the Navy.

Mr. Krinsky graduated from the US Merchant Marine Academy 1960 as BS Marine Engineer, he

subsequently graduated from the American University 1966 as MBA Production Management. After his career as an Engineering Officer in the Merchant Marine he worked in computer industry for IBM and other companies for some years.

He has been associated with the Navy for thirty years as
- Project Officer for Boilers
- Program Manager for Navigation Systems of Aircraft Carriers and Submarines
- Deputy Director for Auxiliary Systems
- Division Director for HVAC and Submarine Life Support Systems
- Division Director Environmental Protection Systems

He is Author of Chapter XXI "Heating, Ventilation, Air Conditioning and Refrigeration" of the 1992 edition of Marine Engineering published by the Society of Naval Architects and Marine Engineers.

Mr. Krinsky will now present his paper on

US Navy Solid Waste Requirements – Past, Present, and Future

Paper 4: Guido van Meel, Antwerp Municipal Port Authority, BE

I like to introduce Mr. Guido van Meel from the Antwerp Municipal Port Authority.

Mr. van Meel graduated from the University of Antwerp 1974 with a Masters' degree in Applied Economic Sciences, in 1975 with a Masters' degree in Economic Planning and Development from the University of Ghent, and in 1991 with a Masters' degree in Environmental Sciences.

After a year as teacher in secondary school he worked a year in the Bookkeeping and Reporting Department of Ford Motor Company and Ford Tractor Europe. 1977 he became Economic Consultant in the City of Antwerp administration. From 1978 to 1988 he worked as a Tax Controller for the Belgian Ministry of Finance.

Since 1989 he is Advisor in fiscal matters and environment, business development manager for industry in the Antwerp Municipal Port Authority.

Mr. van Meel will now present his paper on

Solid Waste Requirements Resulting from the European Draft Directive on Shore Reception Facilities

Paper 5: Alberto G. Garcia, Carnival Cruise Lines, US

I like to introduce Mr. Alberto G. Garcia from Carnival Cruise Lines, Miami, Fl., USA.

He graduated from the Naval Academy of Mariel, Cuba in 1974 as a Marine Engineer. He studied Electric Engineering at the Habana University , Cuba for three years.

He became Naval Chief Engineer in 1980 and moved to United States.
Mr. Garcia sailed as an Assistant Engineer Officer and later as Chief Engineer for 13 years in different classes of ships as reefers, containers, bulk carriers, tankers and Roll on-Roll off.
Since 1987 he worked as Superintendent Engineer in different fleets consisting of bulk carriers, asphalt tankers and lately with passenger ships with Carnival Cruise Lines since 1992.

He has been in his present position since 1997 as Manager Marine Quality Control, for the Carnival fleet; responsible for all issues concerning rules and regulations safety and environmental, Class Society, ISM, Flag Administration and Company procedures implementation in the Marine Operations Department.

Mr. Garcia is a Member of Society of Naval Architects and Marine Engineers since 1990.
He is also member of the Technical Committee of International Council of Cruise Lines

He will now present his paper on

Solid Waste Treatment on Cruise Line Ships – IMO vs. US and Caribbean Port Authorities Requirements

Paper 6: Cornelius de Keyzer, Rotterdam Municipal Port Authority, NL

Mr. Cornelius de Keyzer from the Rotterdam Municipal Port Authority is the last speaker of this session.

Capt. de Keyzer has been involved in the shipping business for 35 years. After graduating from the Nautical Academy Rotterdam he joined the Holland America Line as a junior deck officer. After a career of 11 years in the Dutch, Liberian and Canadian merchant marine he signed off and joined Furness Shipping Agency as marine cargo superintendent and liner manager.

In 1974 he exchanged private enterprise for public service and was 13 years involved in vessel traffic- and port control management at Pilot Maas, Europoort and the Harbour Co-ordination Centre respectively.

From 1987 to 1991 he was appointed as sector Harbourmaster of the Left Bank area of the Port of Rotterdam, after which he switched over from operational to policy management as (senior) advisor Nautical, Safety & Environmental policy for the Directorate Shipping of the Rotterdam Municipal Port Management.

Capt. de Keyzer is also assigned bunker-coordinator for the RMPM. In 1996 he has been elected a counceller of the IBIA, the International Bunker Industry Association.

He will now present his paper on

To be disposed or not to be disposed

Environment and the US Navy Ships

By Dr. Igor Vodyanoy, U.S. Navy, Office Naval Research Europe, London, UK

ABSTRACT

The Congress has passed several pieces of legislation in the last few years concerning environmental issues on Navy ships. The FY-94 Defense Authorization Act prohibited the discharge of all plastic waste from surface ships by 31 December 1998 and codified an installation schedule for Plastic Waste Processors (PWPs).

The PWP was developed by the Navy and reduces plastic waste volume 30:1. It shreds the plastic into small chips, melts, sanitizes and compresses the plastic into sterile round discs weighing about 15 pounds. These discs can be safely stored aboard ship for recycling or disposal when the ship returns to port.

The PWP program is fully funded and on track. Production contracts were awarded in 1995 to two manufacturers. Two hundred and one surface ships will receive the PWP. We have met all legislative milestones to date, including completing 25 percent of all PWP installations by 1 March 1997. We are on track to meet the remaining legislative dates of 50 percent completed by 1 July 1997, 75 percent completed by 1 July 1998, and 100 percent completed by 31 December 1998.

The total cost for research, development, procurement and installation of PWPs is $259 million. of this effort will be to establish clear and uniform U.S. discharge standards for Armed Forces vessels that apply at all military and commercial port facilities across the United States. With such standards in place, we can design, develop, and install effective control technologies aboard Navy ships to meet these standards.

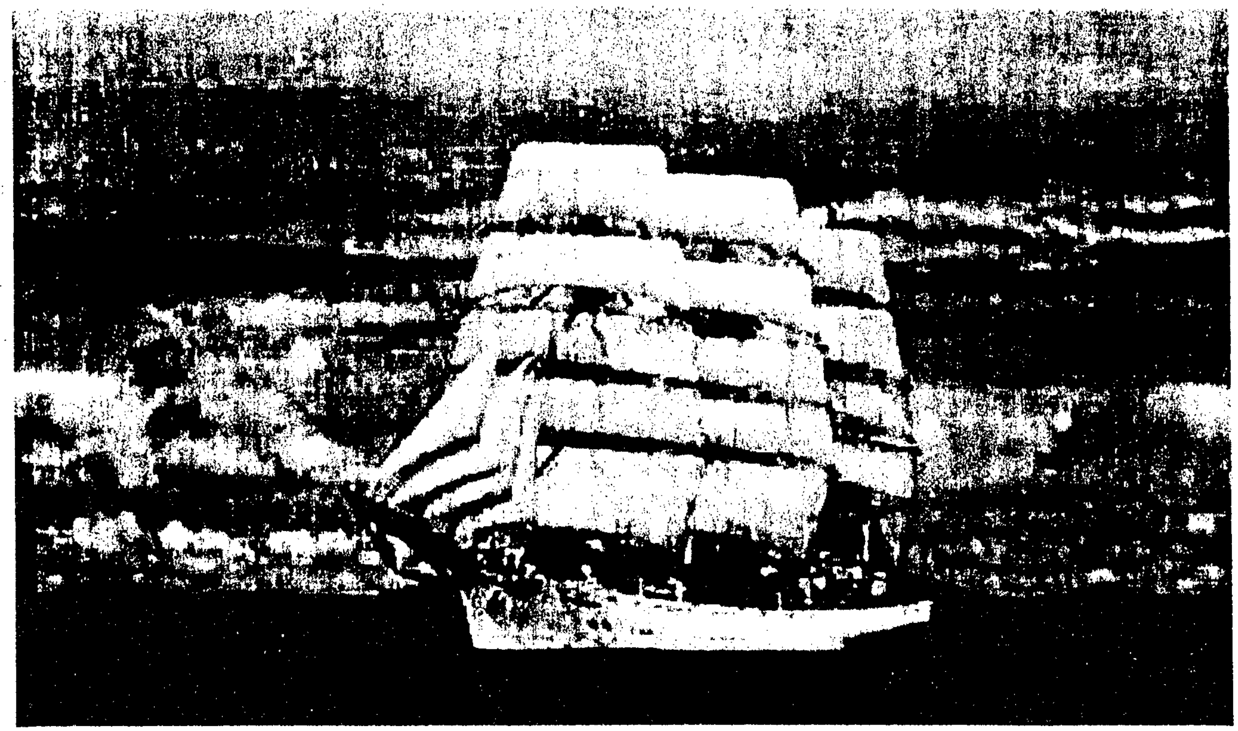
The FY-97 Defense Authorization Act approved Navy plans to install solid waste pulpers and shredders (P&S) in surface ships of frigate size and larger, and to use these devices in special areas and elsewhere to process and discharge waste paper, cardboard, metal and glass. Under the Act to Prevent Pollution from Ships, P&S must be installed and in use aboard surface ships by the end of the year 2000, except for those ships being decommissioned in or before the year 2005. A total of 205 surface ships will receive the P&S. The total cost for research, development, procurement and installation of these devices is $318million. The Navy announced its intention to contract for the manufacture of P&S in the Commerce Business Daily last summer, and plans to award a contract this fall. We plan to complete P&S installation by the December 2000 deadline.

Because of unique space limitations, atmospheric concerns, and other issues, the FY-94 Defense Authorization Act set a compliance deadline of 2008 for submarines to meet plastic waste and non-plastic waste discharge restrictions. Under the direction of an Executive Steering Committee chaired by the Deputy Assistant Secretary for Environment and Safety, the Navy is analyzing alternatives for solid waste management aboard submarines. I expect to submit a report to Congress by the end of this calendar year that will describe our preferred alternative for submarine solid waste management.

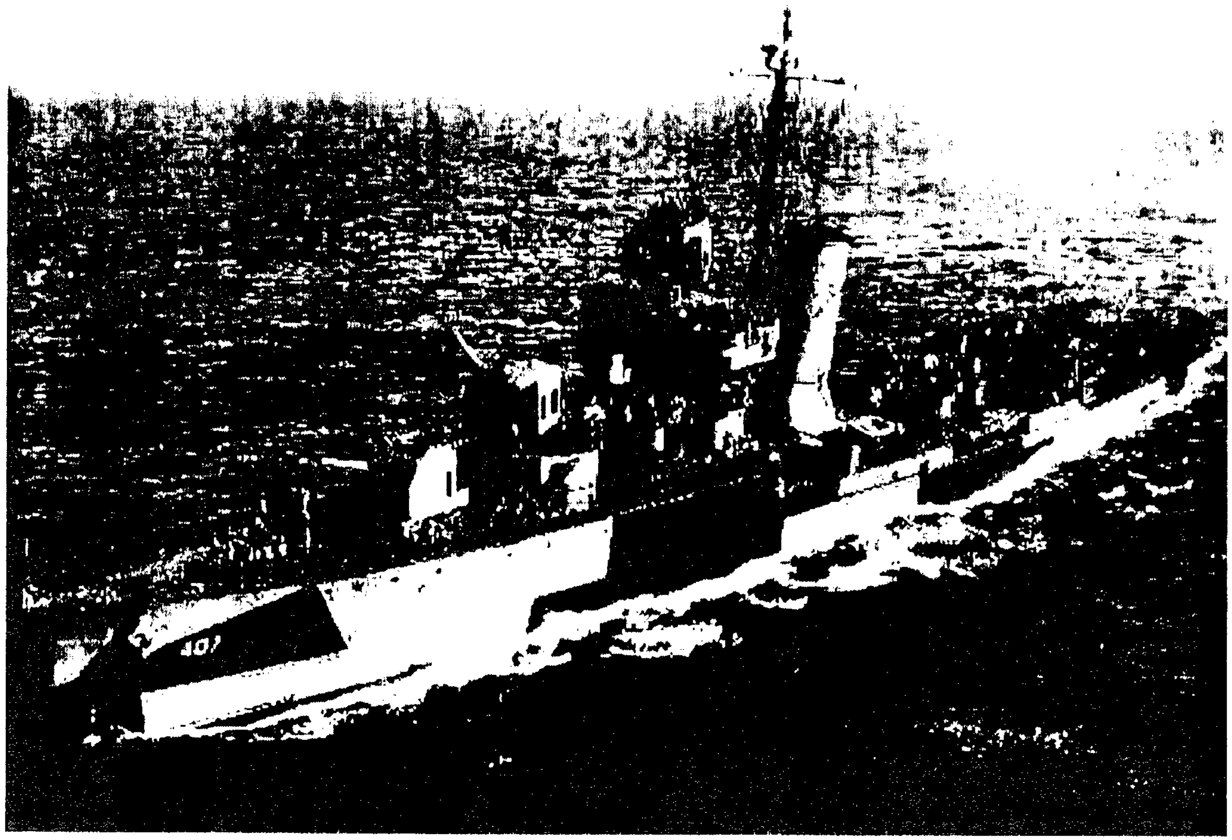
The Navy is working with EPA and the Association of Metropolitan Sewerage Agencies (AMSA) to establish nationwide guidance for Vessel Collection, Holding, and Transfer (CHT) system discharges to Sewage Plants. CHTs store a ship's sewage and gray water (showers, laundry, galleys). Some municipalities wanted to treat CHT effluents as hazardous waste because of the presence of traces of heavy metals. Doing so would have dramatically escalated our treatment and disposal cost. Navy studies provided conclusive evidence that the metals were the result of normal corrosion in pipes and would not harm normal sewage plant operations. AMSA and EPA have supported our findings and conclusions.

Clean Air Act As the designated Department of Defense lead for Clean Air Act (CAA) issues, the Navy has participated in numerous working groups with EPA and OMB. Our objective is to ensure that EPA recognizes and considers unique military concerns before establishing compliance standards. EPA has recently proposed new National Ambient Air Quality Standards (NAAQS) rules for ozone and particulate matter. If new standards are set, states will have up to 3 years to prepare implementation plans, and EPA will consider new rules for mobile sources. The substance and extent of these implementation plans will determine how our operational practices will be affected. Our concerns with this proposed regulation centers on its potential impact on training. Smoke generators are used to simulate combat conditions, and tracked vehicles used on training ranges produce significant quantities of particulate. Both of these operational practices could be dramatically affected by the proposed particulate matter standard. We are also concerned about the cost of acquiring and maintaining permits, and the cost and complexity of equipment upgrades. We need to ensure that emissions and operating limits on military tactical equipment will not impede military readiness and operations. We are engaged with EPA on implementation issues, and are represented by our Regional Environmental Coordinators as the states do their work.

Solid Waste Treatment Requirements and Policies

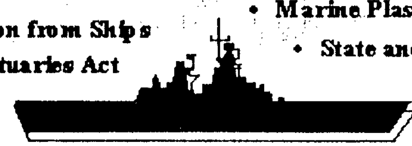


Solid Waste Treatment Requirements and Policies



Solid Waste Treatment Requirements and Policies

- Consider major environmental laws, agreements, and conventions



- Foreign Country Requirements/Status of Forces Agreements (SOFAS)
- Act to Prevent Pollution from Ships
- National Marine Sanctuaries Act
- Oil Pollution Act
- Clean Air Act & Amendments
- National Environmental Policy Act
- Basel Convention
- Clean Water Act
- Resource Conservation and Recovery Act
- Marine Plastic Pollution Research & Control Act
- State and Local Laws & Regulations
- Marine Mammal Protection Act
- MARPOL/IMO
- Endangered Species Act

MARITIME ASPECTS OF NATO ENVIRONMENTAL POLICIES AND ACTIVITIES

Capt(r) Arcangelo SIMI, Head NATO Naval Armaments
Antwerp, 21st April 1999

Ladies and Gentlemen,

It is for me a pleasure and an honour to be here at this conference. It is a pleasure because it's an occasion to meet several friends 1 have worked with over the years. And it is an honour to be asked to speak to this distinguished audience, among whom 1 would like to recognise Mr. Larry Koss, who has been the initiator of many of the NATO efforts in maritime environmental protection. And who, as Chairman of NATO Special Working Group 12, has continued to promote environmental protection policies and activities.

In my presentation 1 will tell you how the awareness of military environmental issues 15 growing in NATO armaments communities, how these problems are being faced, and what will come next.

As noted in the title, this presentation will be focused on maritime matters, which are mainly addressed by SWG/12,. But 1 will also mention other players such as the NATO Committee on the Challenges of Modern Society (CCMS> and the Military Agency for Standardisation (MAS> 1 intend to conclude by highlighting the progress we have achieved in NATO on environment protection — with the involvement of all three services - by means of some words on the draft Standardisation Agreement (STANAG) 7141, which is being developed by MAS.

From the mid-seventies, the United Nations started to establish rules for maritime environmental protection. MARPOL *73/78,* for example, required oily water separators on ships. But in the beginning the concern/interest of Navies was quite limited because they felt „protected" by Article 3 on government vessels — „comply as far as reasonable and practicable". This attitude lasted a few years but soon a consensus arose that „nobody should be exempt from MARPOL".

Consequently in the mid-1980s, the NATO Naval Armament Group - NNAG — which operates under the purview of the Conference of National Armaments Directors, established the first NATO Group — Naval Group 6 Sub-Group 6 - to work on armaments applications for safeguarding the environment.

In that period, general environmental themes were also being addressed by the CCMS, but the scope of that Committee, operating under the Scientific Affairs Division, was different because lt was mainly aimed at keeping open channels of communication with potential adversaries, with theoretical discussions on non-sensitive subjects.

Naval Sub-Group 6 started to work on oily water and shipboard sewage issues... but the port costs continued to rise, the restricted discharge zones began to expand, and national laws began to apply solid waste requirements to naval ships. It was therefore dear that naval vessels could no longer exploit their exemption from anti-pollution regulations, and it also became dear that here was an opportunity to put the navies on the leading edge as an the example as to how the military could take steps to protect the environment. When the Montreal Protocol phased out CFC and Halon

tion, the expertise resident in *SGI6,* which mainly comprised liquid waste experts, was no longer sufficient. Therefore in 1992 under the drive and enthusiasm of Mr. Koss and his colleagues, NNAG established Special Working Group 12 to respond directly to NNAG itself and to cover the full range of shipboard maritime environmental protection requirements.

SWG/12 identified comparable requirements amongst Allied Navies but no technical solutions were at hand.
The task of SWGI12 is shown on the screen.
The new group fashioned its **VISION** to aim towards the „environmentally-sound ship of the 21s century" (ESS-21).

And, responding to the questions:
- what is possible in the next decade?
- how are we to achieve the ESS-21?

SWG/12 Group agreed that its **STRATEGY** would be:

- to work together to save time and money to conduct information exchange, tests and evaluation
- to identify opportunities for co-operation

The activities of the Group were concentrated on the evaluation of applications of the national Policy and procedure and on the assessment of the different experiences of the participating countries *(Belgium ,Canada, Denmark, France, Germany, Greece, Italy, Netherlands, Norway, Portugal, Spain, United Kingdom and United States, and more recently Bulgaria, Finland, Poland, Romania, Russia and Ukraine).* In this period the Navies represented in SWGI12 have tested commercial compactors, grinders, incinerators, oily water separators, and oil content monitors. They have developed garbage machines, plastic waste processors, pulpers, shredders, membrane oily water separators, and have evaluated membrane bio-reactors and advanced vortex incinerators.

Furthermore SWG/1 2 started to look to other NATO Groups for their support and in particular to the Defence Research Group (DRG — nowadays included in the new R&T Organisation) and to the NATO Industrial Advisory Group (NIAG).

In dose co-ordination with SWG/12, DRG conducted a Long-Term Scientific Study on „Environmental Technologies for Application to NATO Military Assets and Bases". The study results substantiated many of the activities already undertaken by navies, but also gave some guidance for future direction of research and development. One important conclusion, for example, was that instead of pursuing individual solutions to individual waste streams, it would be better to develop an <u>integrated</u>, whole-ship approach. Even today, SWG/12 continues to apply the conclusions of this important study to its work.

In 1994, the NATO Industrial Advisory Group (NIAG) was requested to conduct a pre-feasibility study, which lasted 24 months with the participation of 19 companies from seven nations and the investment of about 3 millions of US dollars shared by NATO (MBF 38> and participating companies themselves. This study resulted in the preparation of a NATO Staff Target, which currently forms the basis for some countries to negotiate significant follow-on co-operation.

The activities of SWGII2 included the preparation of seven Allied Maritime Environmental Protection Publications - AMEPPs - plus a maritime environmental protection strategy paper and a technology-interest matrix.

I can talk about AMEPP 4 in particular. Recently, SWG/12 worked closely with Naval Group 6 on

Ship Design to update AMEPP 4 to address „Functional Requirements for the Integration of Maritime Environmental Protection into Ship Design". Working with Naval Group 6 was pursued by SWG/12 not just because they are a group of tine fellows.... SWGII 2 deliberately wanted to bring the naval architecture community onside when it comes to incorporating — from the outset — maritime environmental features into a ship design - and not just as an afterthought.

Different from the STANAGs AMEPPS do not require nations to make a commitment to the prescriptions found in the documents: they are for guidance only. However, they provide a very useful compendium of current technical knowledge and ideas on naval maritime environmental protection, and are major step on the way to a standardised approach to the problems.

In the last 5 years SWGI12 has been fully aware of, and willing to support the new NATO initiative on Partnership for Peace. The group led the way for extension of its activities to include the new Partners. It held the first armaments symposium with Partners in a Partner country in VARNA, Bulgaria, followed by a second one in The Hague, and a third in Jurata, Poland.

Additionally, two expert teams were formed to assist with MARPOL compliance and oil spill prevention in Bulgaria and Romania. Currently, Partner nations routinely participate in the meetings and in the regular meeting-to-meeting work of SWGII2.

So much for the current state of .1...... **For the future,** SWGI1 2 has identified key factors in:

- working with national delegations to the Maritime Environmental Protection Committee of the International Maritime Organisation to write technically sound, achievable and affordable international regulations

- working with national legislation processes to achieve similar goals

- developing a naval concept for environmentally-sound operations for the next century

  actively participating in the development of a NATO military environmental protection standardisation agreement.

To move toward the future, **SWGII2 is re-developing a strategy that will lead the way ahead** for military environmental protection in NATO. It can claim this because SWGI12 is the only armaments group addressing environmental protection in NATO, and indeed the only group specifically dealing with maritime environmental protection in all of the Alliance!

What 5 new in this document still under development?
Let me underline a few key points of this strategy, which 5 intended to promote NATO-wide policy where all services will develop management procedures and sufficient technical capability to meet the intent of the international regulations as far as reasonable, practicable and affordable

Environmental leadership is crucial, a concept that places the work and effort of SWGI1 2 in context. But the desire to provide leadership is not exclusively altruistic.

From the naval point of view, it is better to be out in front with technical pollution prevention solutions and practices designed for the special needs of naval ships. This is seen be a much better situation than being forced to adapt technical solutions and practices first developed for cruise liners!

Fundamentally, the strategy has two objectives - the first is to design and operate naval ships to be as

environmentally-friendly as practicable — to minimise unwanted air emissions and waste generation in the first place, and to permit optimised waste management on board, even if this means storing the waste on board until the next port.

The second objective is in support of the first - to develop shipboard waste elimination systems - that is, to develop equipment to destroy or appropriately treat the many and various waste streams on board.

Apparently these are simple concepts, perhaps even statements of the obvious, but the difficult part is how do we get there from here? What is the way towards what has been called „the zero-discharge ship"?

SWG/1 2 has developed six principles to guide the way and they are shown in the viewgraph.

[The first comes under the heading of Compliance - navies will comply with international and national pollution control regulations as far as reasonable, practical and affordable.
The next is Conservation - navies will use their best efforts to conserve natural and cultural resources.
The third is called Cleanup — navies will use sound risk-identification and risk-management procedures when addressing existing pollution in the environment. Next is Pollution Prevention - navies will use their best efforts and a full range of techniques to prevent pollution.
Under the heading of Training - navies will engender widespread environmental protection awareness in their sailors, and include environmental protection in the curricula of training courses. And lastly, there 5 the principle of International Co-operation - navies will exploit existing NATO mechanisms for international co-operation to identify technology development opportunities, to move towards international interoperability and standardisation, and to save time and money.]

With these principles to guide the way, the strategy paper then proceeds to discuss the core of the strategy - how to achieve the objectives. It addresses the major waste streams of oily waste, non-oily waste water, solid including medical waste, and hazardous materials. I'm not going to mention in detail the many technical developments and techniques being explored by navies to work towards the environmentally-sound ship. Let me just say that a lot of effort is underway, and navies, through fora like SWG/12, continue to exchange Information and seek forms of co-operation. Steady progress is being made and will continue.

have already mentioned other initiatives undertaken to make the environmentally-sound ship a reality - the industrial pre-feasibility study and the long-term scientific study. In addition, SWG/12 will continue to pursue greater liaison with other bodies having a relation to maritime environmental protection matters.

The Group is looking to expand its range of contacts, which in several cases can only be exploited through the national members, especially with the Maritime Environmental Protection Committee of the IMO . Links with the European Union are being investigated, and the group is looking into possible liaison with national classification societies through Naval Group 6.

But as I promised, it is now time to have a look to what the CCMS is doing!

The CCMS marshals the co-operative efforts of nations, often from non-military sectors, in a series of pilot studies and short term projects in which experience is shared, data is analysed and practical recommendations are developed for the NATO North Atlantic Council and national authorities. At present there are 15 on-going activities, which involve NATO and Partner experts. Partners can propose new studies provided that there is an Alliance country as co-pilot and at least two other

Alliance countries as participants. A NATO-Russia MOU is in force on Environmental Protection.

The ongoing studies are as shown in the viewgraph:

- Advanced cancer risk assessment methods

- Clean products and processes

- Environmental aspects of re-using former military lands

- Environmental management systems in the military sector

- Environmental and security in an International context

- Emerging technologies for the treatment of contaminated land and groundwater

In 1998 one new pilot study and two new short-term ad hoc projects were launched as on the screen. The pilot study concerns regional/ trans-boundary transport of air pollution.

And the projects are:

- Review of environmental projects of the Caspian Sea for the planning of future activities. (The study , which cover interesting maritime aspects, is led by Turkey and intend to contribute to sustainable development of the Caspian SEA littoral and neighbouring regions).

- Pollution prevention Seminar

None of these initiatives 5 particularly targeted to Naval systems, but several of them cover some aspects relevant to Navies. You may find additional information relevant to these studies on the CCMS website — **www.nato.intlccms.**

And now let me say a few words on the development of draft SIANAG 7141, which 5 the first comprehensive official agreement amongst NATO nations concerning environmental protection. I believe it 15 sate to say that the initiative has been prompted by the outstanding results achieved by SWGI12 in the maritime environment arena.

In 1996, several countries advanced a proposal to the Military Agency for Standardisation to examine the possibility of developing a STANAG for ,environmental standards in joint (that is, combined navy, army and air force) operations". The drive was provided by SWG/12, and the basis for the STANAG has been the „Pilot Study on Defence Environmental Expectations" carried out by the CCMS.

At present the STANAG is in draft form, and not yet ready for distribution. Nevertheless it may be useful to note the main features of this STANAG.

First of all the aim: „To adopt NATO environmental policy and doctrine for Armed Forces' operations and to provide procedures of environmental planning during military operations and training".

The NATO environmental policy is laid down in Annex 1, the environmental doctrine including peacetime exercises and contingencies operation will be included in Annex 2, and Annexes 3 and 4 will cover, respectively, environmental procedures and environmental training.

Clearly defined is the Military Commanders' responsibility in achieving the military task with a full commitment to environmental quality. All Commanders, in tact, are called upon to demonstrate leadership in environmental protection and to promote environmental awareness in personnel. They should identity and budget resources to meet environment quality objectives and incorporate environmental requirements in decision making.
[Relationships with neighbouring communities should be enhanced by addressing environmental issues, and careful use should be made of the land and other natural resources under control. Last but not least, reduction of the waste generation and pollution should be pursued on a constant and determined way through minimisation, materials substitution, waste management and the promotion of recycling.]

Very significant is the following statement from the STANAG:
„Victory in war is the primary function of the Allied Forces and nothing must stand in the way to accomplish this objective; nevertheless a concern about environmental damage during war is a factor which should be considered at least during the planning phase."

Let me conclude making one last point with a crucial remark concerning the operational requirements of NATO forces. Twenty years ago navies started addressing environmental protection as a moral issue - despite exemptions, navies should contribute to the protection of the marine environment because it was the right thing to do. But Governments then came to the same conclusion - and started insisting that their navies comply with national and international regulations and laws. That is, for navies, environmental protection had become a regulatory and legal issue.

But today, the issue has developed into something even more critical to the capability of our naval forces - and indeed to that „victory" mention earlier. Maritime environmental protection is now a significant military operational requirement. A ship without suitable environmental protection will simply not be allowed to operate in certain areas or enter restricted waters or even harbours. Such a ship will thus not be suitable, for example, for peace-keeping or even peace-enforcement Operations. There are strong indications that the other two services are also coming to similar conclusions for their own forces. And this is a message just now finding its way into senior military headquarters in the Alliance.

With that remark on the ever-growing importance of maritime environmental protection for the military services, I can conclude my presentation this morning. would be pleased to answer any questions you might have ....

S1P2-PICT.PPT

Head, NATO Naval Armaments Section

Captain(r.) A. SIMI

21st April 1999

MARITIME ASPECTS OF NATO ENVIRONMENTAL POLICY AND ACTIVITIES

Presentation to the International Conference on "The Maritime Environment", Antwerp

Outline of the Presentation

- **SWG/12**
  - **the beginning**
  - **the vision**
  - **the strategy**
- **Committee on the Challenges of Modern Society (CCMS)**
- **Military Agency for Standardization (MAS)**
  - **STANAG 7141 EP**

Significant historical events

- MARPOL 73/78
- ART.3 - Naval Vessels "protection"
- consensus on "nobody is exempt"
- 1984 - Establishment of NG/6-SG/6
- CCMS
- CFC and Halon phasing out
- 1992 Special Working Group 12 SWG/12

SWG/12 on Maritime Environmental Protection

TASK: to promote the development of capabilities to comply with international maritime environmental protection regulations and to foster COOPERATIVE efforts for achieving environmentally sound ships and support facilities.

S W G / 1 2

- **<u>VISION</u> : Environmentally-Sound Ship of the 21st Century - ESS-21**
- **<u>STRATEGY</u>:**
  - **to work together to save time and money**
  - **to conduct info. exch., tests and evaluation**
  - **to identify opportunities for cooperation**
- **<u>PARTICIPANTS</u>: BE, CA, DE, FR, GE, GR, IT, NL, NO, PL, PO, SP, UK, US, + BUL, FIN, ROM, RUS, UKR**

S W G / 1 2

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AMEPPs

- AMEPP 1 POLLUTION ABATEMENT POLICIES
- AMEPP 2 DISPOSAL OF WASTE
- AMEPP 3 EQUIPMENT CATALOGUE
- AMEPP 4 FUNCTIONAL REQ'TS
- AMEPP 5 ALTERNATIVE SOLVENTS
- AMEPP 6 HAZARDOUS MATERIAL OFFLOAD
- AMEPP 7 GLOSSARY OF TERMS

Partnership for Peace (PfP)

- **1995 Symposium in Varna - Bulgaria**
- **1996 Symposium in The Hague - NL**
- **1997 Symposium in Jurata - Poland**

- **MARPOL/Oil Spill Specialist Teams**
  – visits to Bulgaria and Romania

KEY FACTORS for the future

- working with :
  - IMO for technically sound, achievable and affordable regulations
  - national legislation processes
- developing a naval concept for environmentally-sound operations
- participating in the development of a military environ. protection STANAG

RE- DEVELOPING A STRATEGY

- Promote NATO-wide policy (all services)
- Naval environmental leadership
- Be out in front with technical solutions
- Design and operate environmentally-friendly naval ships
- Develop shipboard waste elimination systems
- 6 principles

The six principles

- Compliance
- Conservation
- Clean up
- Pollution prevention
- Training
- International cooperation

Ongoing CCMS STUDIES

- Advanced cancer risk assessment methods
- Clean products and processes
- Environmental aspects of re-using former military lands
- Environmental management systems in the military sector
- Environment and security in an International context
- Emerging technologies for the treatment of contaminated land and groundwater

New CCMS STUDIES & WEB

- Regional/trans-boundary transport of air pollution.
- Review of environmental projects of the Caspian Sea for the planning of future activities.
- Pollution prevention seminar

www.nato.int/ccms

STANAG 7141

- TITLE: ENVIRONMENTAL STANDARDS IN JOINT OPERATIONS
- AIM : to adopt NATO environmental policy and doctrine for Armed Forces operations, and to provide procedures for environmental planning during military operations and training

STANAG 7141- Annexes

- 1. POLICY
- 2. DOCTRINE
- 3. PROCEDURES
- 4. TRAINING

V I C T O R Y

- **Victory in war is the primary function of the Allied Forces and nothing must stand in the way……**
- **Nevertheless a concern about environmental damage during war is a factor which should be considered ……**

CONCLUSIONS

- MEP is now becoming a Military Operational Requirement
- A ship without suitable MEP might not be allowed to operate
- The other two services are coming to similar conclusions on compliance

MARITIME ASPECTS OF NATO ENVIRONMENTAL POLICY AND ACTIVITIES

T H E

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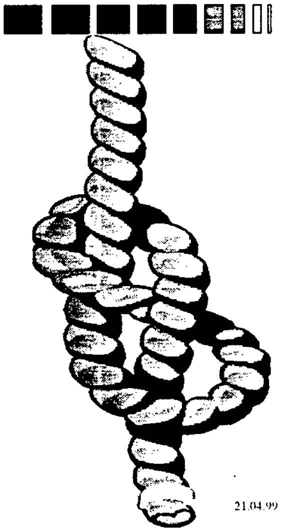

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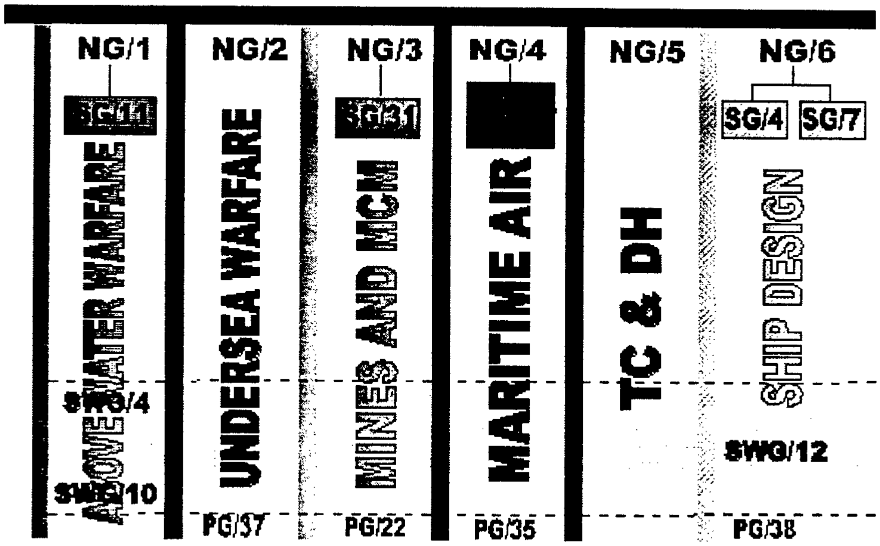
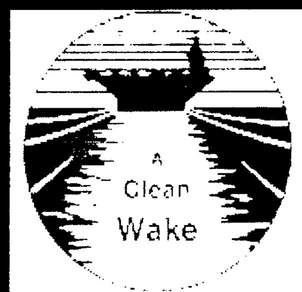

NG/1
SG/11
ABOVE WATER WARFARE
SWG/4
SWG/10
NG/2
UNDERSEA WARFARE
PG/37
NG/3
SG/31
MINES AND MCM
PG/22
NG/4
[redacted]
MARITIME AIR
PG/35
NG/5
TC & DH
NG/6
SG/4
SG/7
SHIP DESIGN
SWG/12
PG/38

U.S. Nay Solid Waste Requirements – Past, Present, and Future
By Mr. Joel Krinsky

ABSTRACT

Article 3 of the MARPOL 73/78 Convention states that "the present Convention shall not apply to any warship, naval auxiliary, or other ship owned or operated by the State ......
However, each Party shall ensure by the adoption of appropriate measures not impairing the operations or operational capabilities of such ship, that such ships act in a manner consistent, so far as reasonable and practicable, with the present Convention."
In the mid 1980's, the U.S. Navy embarked on a program to achieve "no floating debris", as a reasonable, practicable, and affordable approach to meeting MARPOL Annex V requirements. In 1987, the Act to Prevent Pollution from Ships (APPS) was modified by the Marine Plastic Pollution Research and Control Act (MPRCA) to require navy ships to fully comply with MARPOL Annex V by 1993.
During this time, the U.S. Navy adopted the 3 day/20 day rule requiring its ships to retain nonfood-contaminated plastics on board for the last 20 days of a voyage and food-contaminated plastics for the last 3 days. The Navy then worked with the U.S. Congress and obtained additional time to develop. Manufacture, and install plastics waste processors on surface ships and determine the ability of all navy ships to fully comply with Annex V "Special Area" no discharge requirements.
The presentation outlines historical U.S. Navy solid waste requirements, the approach the U.S. Navy has taken to comply with national law for current ships, and the work ongoing to meet the solid waste processing requirements for environmentally sound ships of the 21st century.

U.S. Navy Solid Waste Requirements - Past, Present, and Future



21 April 1999

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International Regulations

Mid 1970's

- **MARPOL 73/78 Places Discharge Restrictions on Ships**
- **Article 3 Exemption for Public Vessels**
  - Comply as Far as Reasonable and Practicable
    - Pump and Dump as Required
- **U.S. Navy Begins Solid Waste Disposal R&D Effort**

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Regulations Evolve

Mid 1980's

- Increasing Pressure to Preserve Quality of Life
- Nations Concerned with Beach Litter
- MARPOL Annex V on Solid Waste Enters into Force
  - Prohibit Discharge of Plastics Anywhere
  - No Discharge Special Areas
- National Laws Begin to Place Environmental Requirements on Navies

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Act to Prevent Pollution from Ships (APPS) - 1980

- APPS Initially Exempted U.S. Navy Ships
- Marine Plastic Pollution Research and Control Act (MPRCA) of 1987 Modified APPS
  - Required Navy to Comply with MARPOL Annex V Requirements by 1993 (5 Years)
  - Did not Include "Reasonable and Practicable" Compliance Provisions of MARPOL
    - Zero Discharge of Plastics
    - Special Area Restrictions
- Navy Imposed 3day / 20 Day Rule in 1989

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Navy Environmental Leadership

- 1979 - Navy Awards Contract for Trash Compactor Design Study
- 1980 - Navy Awards Contract to Develop and Test Shipboard "Sinkable Slug" Compactors
- 1985 - Navy Begins Solid Waste Pulper Development
- 1987 - Navy Begins Plastic Waste Processor Development
- 1988 - Navy Initiates Advanced Thermal Destruction R&D

Early Years

- **Tested Compactors and Incinerators**
  - Deficiencies Included Reliability, Maintainability, Safety, and Sanitation
  - FFG-7 Class Originally Built with Incinerator
    - Removed Because of Reliability Problems and Fire Hazards
- **Began Development of the Shipboard Vertical Trash Compactor (SVTC)**
  - Designed to Shred and Compact Mixed Solid Waste (Including Plastics) into a Sinkable Slug

Navy Constraints

- **Real World Requirements**
  - World-Wide Operations
  - Long Mission Duration
  - Military Mission Effectiveness Can Not Be Compromised
- **Real World Ships**
  - Existing Fleet - What You See is What You Get
- **Real World Budgets**
  - Backfit is Expensive
    - Installation is 5 to 7 Times Procurement Cost

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Impact of "No Plastics" Regulation

- **Navy Reviewed Solid Waste Processing Requirements**
  - SVTC Testing Revealed Buoyancy Issues with the "Sinkable Slugs"
- **Separate Solutions for Solid Waste Adopted**
  - Plastic Waste Processors
    - Zero Discharge
  - Solid Waste Pulpers and Metal and Glass Shredders
    - No Floating Debris
- **Navy Needed More Time to Comply**

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FY 1994 National Defense Authorization Act

- Granted Extension to MPRCA Compliance Date
  - 31 December 1998 for Surface Ships
  - 31 December 2008 for Submarines
- Directed Navy to Install Plastic Waste Processors (PWPs)
- Codified 3/20 Rule
- Required Navy to Submit a Plan for Compliance by November 1996

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FY 1997 National Defense Authorization Act

- Modified APPS to Allow Certain Navy Ships to Discharge without Regard to the Special Area Requirements of MARPOL Annex V Non-Plastic, Non-Floating Debris
  - Slurry of Seawater, Paper, Cardboard, or Food Waste Capable of Passing through a 12 mm Screen
  - Metal and Glass Shredded and Bagged to Ensure Negative Buoyancy
- Sense of Congress
  - Adopt Full MARPOL Compliance as a Goal
  - Develop Environmentally Sound Ships

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Solid Waste Equipment

- **Plastics Waste Processor (PWP) System**
  - All Designated Surface Ships have been Outfitted with PWPs since Dec 98
- **Less Volume on Return to Port**
  - 30 lbs/hr into 21" Disks for Onboard Storage
  - Commingled Plastic Needs New Recycling Markets

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Solid Waste Equipment

- **Paper and Cardboard**
  - Hydro-Macerator (Pulper) System Discharges Benign Slurry
  - Large SWP has 680 lbs/hr Processing Rate
  - Small SWP has 140 lbs/hr Processing Rate
  - SWPs will be Installed Throughout the Surface Fleet by 2001
- **Less Volume on Return to Port**

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Solid Waste Equipment

- **Metal and Glass**
  - Solid Waste Shredder Processes Metal and Glass into a Benign Sinkable Form for Bagging and Disposal at Sea
    - 250 lbs/hr Processing Rate
  - SWSs will be Installed Throughout the Surface Fleet by 2001
- **Less Volume on Return to Port**

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Afloat Waste Reduction Efforts

- Alternative Packaging
  - WRAPS / PRIME
- HM Control and Management
  - CHRIMP, HICS, HAZMIN Centers
- P2 Afloat Program
  - Alternative Technologies, Materials, and Processes
  - Equipment Procurement and Installation has Commenced

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Industry Studies The Problem

- NIAG Pre-Feasibility Study on Environmentally Sound Ships
- Shipboard Thermal Waste Treatment Conference
- Shipboard Solid Waste Treatment Conference

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Requirements for Tomorrow!

- Thermal Destruction for Solid Waste
  - Advanced Incineration
  - Plasma Arc
- Thermal Destruction for Liquid Waste
  - Integrated Liquid Destruction System (ILDS)
    - Blackwater, Graywater, and Oily Water Concentrates
- Integrated Thermal Destruction System
  - Capable of Meeting Solid and Liquid Waste Destruction Requirements

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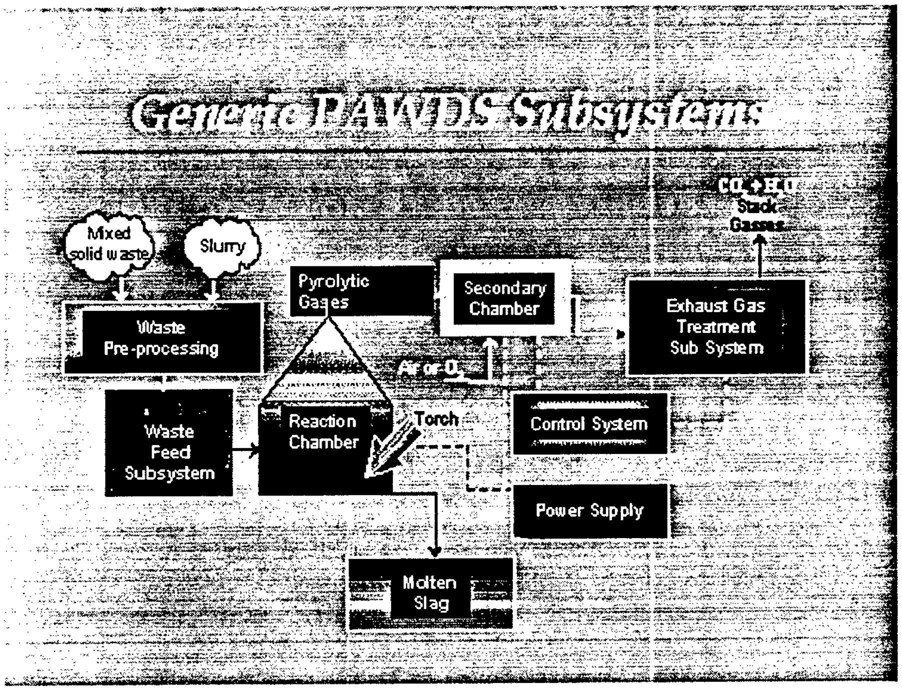
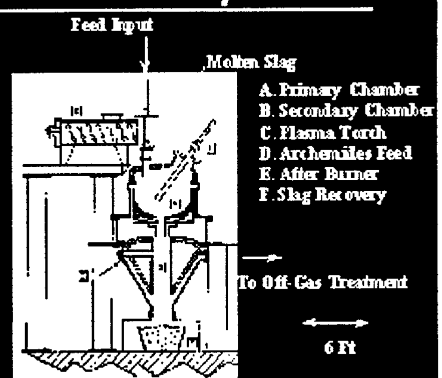


Requirements for Transition of Commercial PAT to Ships

- Reduce size and weight
- Minimize manning requirements
  - Number
  - Training level
- Marinize Hardware
  - Compatible materials
  - Meet shock, vibration, EMI, etc. requirements
  - Tolerate platform motion
- Rapid startup and shutdown
- Large waste stream variation in volume and composition
- High organic content waste stream



Land-Based
Plasma Centrifugal Furnace

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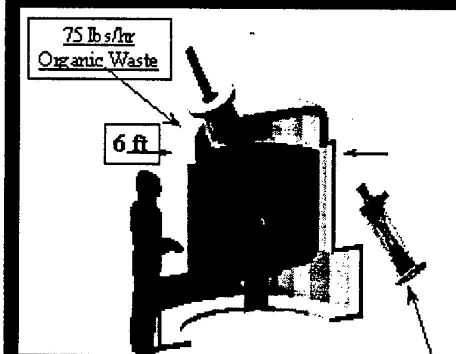
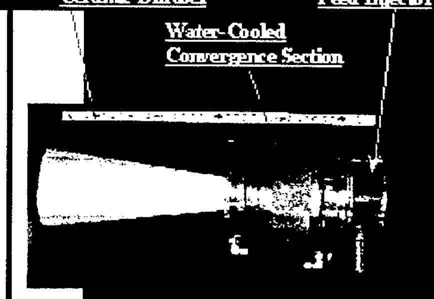
Size Comparison
(Commercial Unit Vs Eductor Geometry)

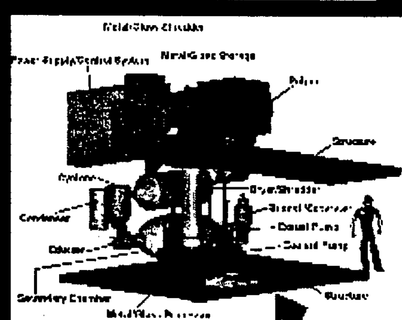


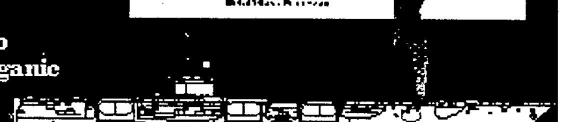


Navy-Developed Plasma Eductor Hardware

Notional (PAWDS) Shipboard Configuration

- **Basic components of shipboard PAWDS**
- **Two units operating processing 425 lbs/hr–18 hours/day**
  - Organic 300 lbs/hr
  - Inorganic 125 lbs/hr
- **Option for one or two deck installation**
- **Unit volume under 3333 cubic feet**
- **Pulpers could be used to transport much of the organic waste**





International Cooperation for Environmentally Sound Ships of Tomorrow

- NATO Staff Target
- Joint ANEP/AMEPP with NG/6 on Functional Requirements for MEP
- US/UK Joint Feasibility Study
- Performance and Procurement Specifications being Incorporated into New Building Requirements

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Controlling Our Destiny - Work Smarter

- Working with National Delegations to IMO/MEPC to Write Technically Sound, Achievable and Affordable Rules
- Working with National Legislation Process to Achieve Similar Goals
- Participate in STANAG Development

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Ship to Shore Interface and ESS-21

- Reduced Manning = Less Waste
- Fewer People to do the Work = Greater Reliance on Shore Based Maintenance
- Increased Automation = Increased Complexity = Need for Professional Repair and Maintenance
- Shore Support will Continue to be Essential



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Conclusions

- Solid Waste Equipment Program Meets U.S. Navy Needs Today
- Comprehensive RDT&E Effort Underway to Meet ESS-21 Requirements
- International Dialog and Cooperation is Key to Achieving ESS-21
  - MEP Technical Symposia are Extremely Valuable

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Solid Waste Requirements Resulting from the European Draft Directive on Shore Reception Facilities

By Guido Van Meel, Adviser Antwerp Port Authority

Abstract

It is generally recognised that the amount and extent of discharges of waste and cargo residues at sea from ships is unacceptable. For this reason the European Commission tabled a proposal for a council directive on port receptions facilities for ship generated waste and cargo residues.

The Directive focuses on the operations of ships while in ports. As a result of this approach port authorities are confronted with new responsibilities. Port authorities have to collect a substantial fee from every vessel calling at the port and they have to ensure that adequate reception facilities are available, sometimes by launching a public tender. Taken into account that in the Hamburg – Le Havre range most facilities are operated by private waste contractors and that the reception facilities are used below capacity (only 5 % to 10 % of the vessels are discharging their ship-generated waste) port authorities are confronted with a "problem".

This contribution will give a view on the problem of ship waste from a point of view of a port Authority.

Solid Waste Requirements Resulting from the European Draft Directive on Shore Reception Facilities

By Guido Van Meel, adviser of the Antwerp Municipal Port Authority on the occasion of the international Conference and exhibition on "Solid Waste Treatment Technologies for ships"

Mister Chairman,
Ladies and gentlemen,

I am pleased to speak on this occasion. My contribution will tackle the problems of a port administration which is confronted with the implementation of the proposal for a council directive on port reception facilities for ship-generated waste and cargo residues.

For evident reasons, already mentioned by other speakers, the European Commission found the legal and illegal discharges of waste and cargo residues from ships at sea unacceptable. The Council therefore approved a resolution on "a common policy on safe seas".

In this policy document the commission proposes a strategy to promote the availability and the use of port reception facilities (within the European union). In line with the "white paper" the commission tabled a proposal for a council directive on port reception facilities for ship generated waste and cargo residues.

This Directive has exactly the same objective as Marpol 73/78, namely to protect the marine environment from operational pollution by ships, regardless of their flag, with a view to eliminating such pollution. However, rather than regulating discharges of ships while at sea, which is the aim of the Marpol 73/78 rules, here the focus is on the operations of ships while in ports.
The different approach from that adopted in Marpol 73/78 implies that the Directive has to address a number of matters which are not dealt with in the current international regime such as the provision of adequate reception facilities, and the setting up of an effective control in order to ensure the effectiveness of the measures.

What are the main lines of the European policy

1. The Commission will lay down more specific standards covering the requirements for ports and port states to provide adequate reception facilities. A fundamental element in this context is the obligation to develop waste reception and handling plans in all ports for the reception and treatment of waste and residues. This plan requires ports to estimate the needs of the ships (normally calling there) and to take appropriate measures to meet those needs.

2. The Commission tries to ensure that reception facilities will be used . The key element in their policy is the mandatory discharge principle. This means that all ships, with a few exceptions, must deliver their ship-generated waste before leaving a Community port, unless the master of the ship is able to demonstrate that the storage capacity for ship-generated waste is sufficient.

3. In order to ensure co-operation between ships and the other authorities and parties involved, the master is obliged to report in advance, to the next port of call, information on storage capacities and the amounts of waste and residues on board together with his intention to use the reception facilities.

4. The ports have to establish cost recovery systems which encourage the use of reception facilities. The Directive does not specify any particular cost recovery system. A "direct" fee system whereby only those deliver their waste pay for the service is excluded because it provides no incentive for ships to dispose their waste a shore.

5. The last element concerns the control of compliance with the Directive. The main tool will be spot-checks carried out by the authorities of the Member States. To conclude, one can say that the Directive will implement the Marpol 73/78 obligations in a harmonised way throughout Europe.

Port authorities themselves however are confronted with new, unknown developments. In north western Europe the major ports are municipal ports, limiting themselves to being a landlord port and a provider of infrastructure. The implementation of the Directive obliges port authorities to co-ordinate and monitor the discharge of ship waste. On top, port administrations have to collect a "substantial" fee from every vessel calling that port in order to ensure that adequate reception facilities for ship-generated waste are available.

This view encloses the obligation to go for a public tender in order to ensure the necessary services.

What refuse is to be discharged in the port ?

The Directive refers to ship-generated waste. Ship generated waste means all waste and residues, other than cargo residues, which are generated during the service of the ship and fall under the scope of Annexes I and V of Marpol 73/78 and cargo associated waste as defined in the Guidelines for the implementation of Annex V of Marpol 73/78.

Mandatory discharge of cargo residues is not included in the Directive.

Even with these short and clear definitions, a port administration will probably have a lot of problems in relation to the reception of "garbage".

According to Marpol 73/78 garbage or annex V "means all kind of victual, domestic and operational waste excluding fresh fish and parts thereof, generated during the normal operation of the ship and liable to be disposed of continuously or periodically except those substances which are defined or listed in other annexes to the present Convention".

If you look to the requirements for the different types of waste, then port administrations are confronted with a complex situation.
According to EC-legislation food waste has to be burned in an incinerator and the container or receptacle has to be disinfected .

But annex V includes also incinerator ashes, from shipboard incinerators, soot, oily rags, empty bottles of thinner, drums for paint, used spareparts of the engine etc.

Sometimes there are specific European, national or local requirements for the handling of these types of waste. In that case one has to provide the vessel with a series of different containers which are labelled in such a way that a vessel can sort its waste. In normal circumstances 4 to 5 containers are necessary for the reception of the waste. If you receive 40 to 50 vessels a day the handling of the containers can create a logistical and financial problem.

On top of this complex situation, the Commission also made the discharge of cargo associated waste mandatory. This means that every vessel has to pay a substantial fee for the removal of dunnage, shoring, pallets, lining and packing materials, plywood, paper, wire and steel strapping etc.

In my port the actual situation is like this that the local stevedore handles this type of waste. He does this in such a way that he reduces the cost as much as possible.
So the stevedore will look for opportunities to reuse the dunnage for outgoing cargo, he will separate the different types of packing material to be in line with the legislation.

In the draft proposal the responsibility will be with the port authority.

The effect could be negative in such a way that the incentive to recycle or to sort the waste during the expensive working hours of a docker will disappear.

Ladies and gentlemen. I am sorry that I cannot present an ideal solution for a waste problem, I can only ask questions. And, for us, the main question is : How can a port authority handle ship's waste at a reasonable cost, which is distributed in a fair way over all the vessels, taking into account that there is a severe competition in the Hamburg – Le Havre range.

I have no tailor made solution at this moment, I hope the European ports will have one before the introduction of the directive.

I thank you.

S1P5-ABSTR.DOC

Solid Waste Treatment on Cruise Lines Ships , IMO vs US and Caribbean Port Authorities Requirements.

AUTHOR: Alberto G Garcia
ORGANIZATION: Carnival Cruise Lines

ABSTRACT

Since 1973 and during the last two decades IMO through the MEPC have made great efforts to improve the Marine Pollution Prevention in the Marine Industry. In order to comply with all the new rules and regulations adopted by IMO many countries have issued their own rules, base on their interpretations, which in many cases have become more stringent than the intentions of the of the IMO rules themselves.

In general, fact is: the marine industry seems at times over regulated.

The purpose of the presentation is simply to show manufactures around the world the needs of the cruise industry, regarding pollution prevention equipment, based on the Carnival experience in the United States and the Caribbean operation, in order to comply with the international requirements and the local port states as well.

The United States ports have become the mayor players of the cruise industry in the occidental hemisphere, where local regulations are complicated, extensive and very strict. As a consequence more stringent requirements are imposed to the ship operators.

Some typical regulatories examples will be presented were more demanding building standards are required for compliance with US and Caribbean countries local regulations.

The US regulations are contained in the CFR (Code of Federal Regulations), based on studies done by the EPA (Environmental Protection Agency). Last revision was done in 1997. These regulations are applicable nationwide, however they vary from state to state, some states being more stringent than others.

A general explanation on USA CFR and Caribbean countries rules, and examples will be cited to demonstrate their differences in comparison with the standard IMO regulations.

Information on the handling of solid wastes in he US and the Caribbean will be presented.

Solid Waste Treatment on Cruise Lines Ships IMO vs. USA and Caribbean Port authorities Requirements.

Carnival®

Introduction

During the last two decades the Cruise industry worldwide have grown at a very high Percentage per year.

Statistics shows that the order book for new vessel have increase in 21% since Feb. 1996 to Feb. 1999

Year	No. of Ships	No. of Berths
Feb. 96	31	49262
Feb. 99	39	65461

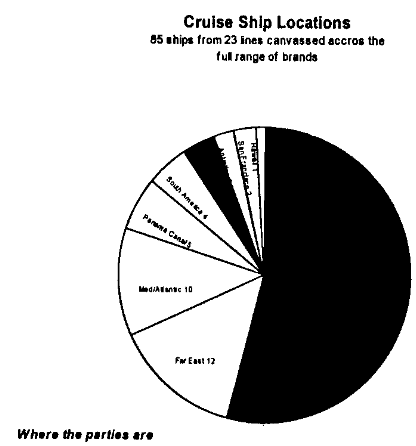
The handling of all wastes from the vessels have became an small processing industry inside the Vessel which have to be efficient, economic and in compliance.

The first priority of the ship owners is to be in compliance with the regulations, to avoid big fines imposed by the regulatory authorities, but also all the bad publicity repercussions as consequences.

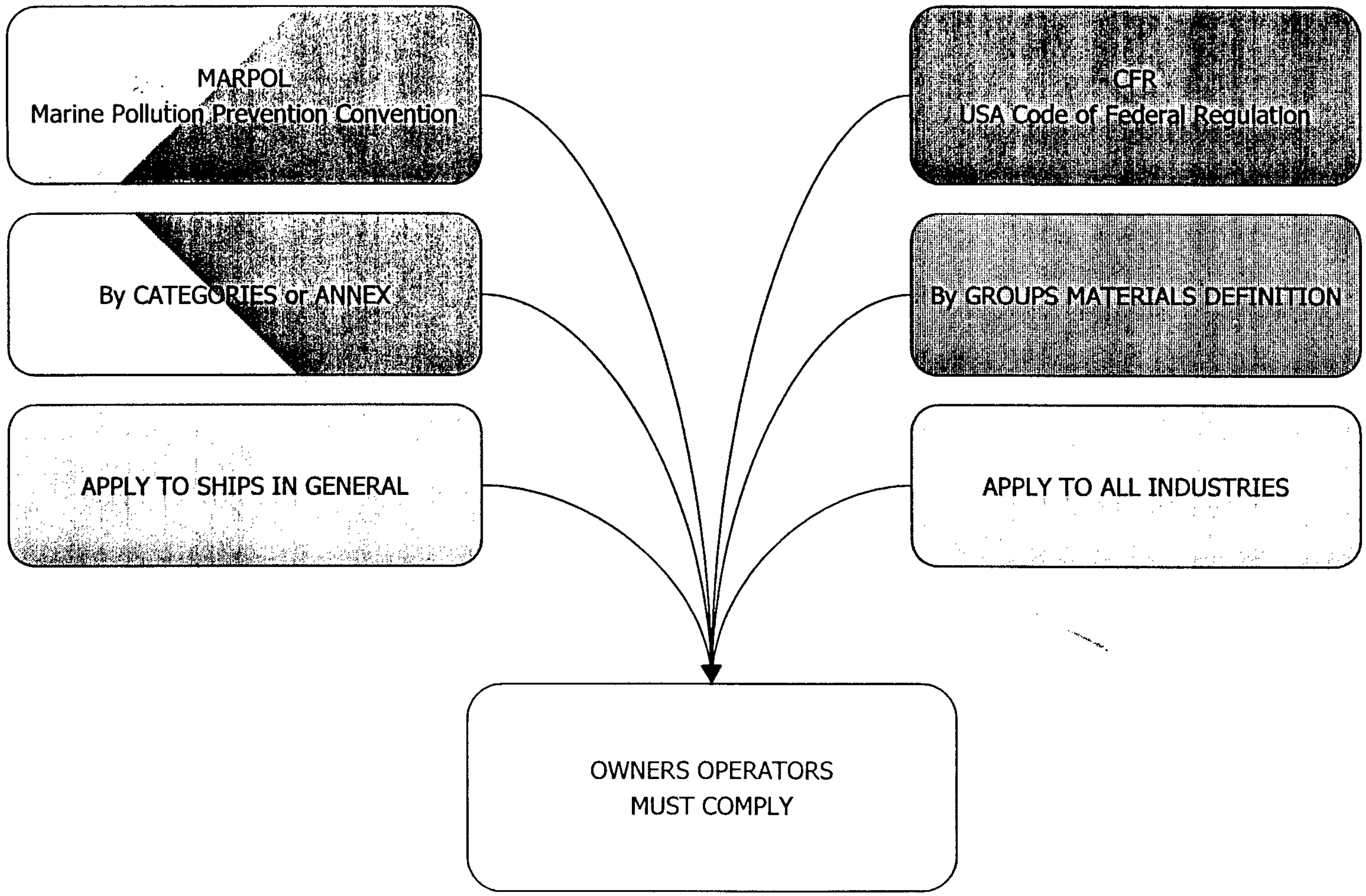
Actually IMO through MEPC marine Environmental Protection Committee and all signatories nations to the assembly, have adopted many rules for the prevention of pollution, however in this complicated process, many countries have created their own rules, that in some cases are non exactly compatible with the international rules, and therefore more stringent.

As Carnival fleet operate mainly in the Caribbean and the USA as the homeport for most of the vessels, we are referring mainly in this presentation to the rules and regulations of Marpol ant he USA local rules as they are more stringent than the Caribbean countries for the compliance's purposes.

Below is shown the vessels distribution of 23 lines globally, note the dense operation of cruise ships in the Caribbean region.



Rules and Regulations composition



MARPOL

Annex I	Regulations for the Prevention Pollution by OIL
Annex II	Regulations for the control of Pollution by Noxious Substances
Annex III	Regulations for the Prevention of Pollution by Harmful Substances
Annex IV	Regulations for the Prevention of Pollution by Sewage (not in force)
Annex V	Regulations for the Prevention of Pollution by Garbage
Annex VI	Future for Prevention of Pollution from Emissions

DEFINITIONS

OIL	**Means petroleum in any form including crude oil, fuel oils, sludge, oil refuse and redefined products (other than petrochemicals which are subject to the provision of Annex II of the convention). Note appendix I.**
NOXIOUS LIQUID SUBSTANCES	**Means any substance designated in appendix I to the Annex II. Note appendix I.**
HARMFUL SUBSTANCES	**All substances which are identified as marine pollutant in the IMDG code, as per guidelines note appendix.**
SEWAGE	**Means drainage and other wastes from any form of toilets, urinals and WG scuppers.** **Drainage from medical premises.** **Drainage from spaces containing living animals.** **Other waste waters when mixed with drainage defined above.**
GARBAGE	**Means all kind of victual, domestic and operational waste excluding fresh fish and parts there of generated during normal operation of the ship and liable to be disposed of continuously or periodically except those substances which are defined or listed in other Annexes.**
Note:	**GRAYWATER and DISHWATER are not included as garbage in the Annexes.**

Appendices to Annex I of MARPOL 73/78

Appendix I

List of oils*

Asphalt Solutions
Blending stocks
Roofers flux
straight run residue

Oils
Clarified
Crude oil
Mixture containing crude oil
Diesel oil
Fuel oil no. 4
Fuel oil no. 5
Fuel oil no. 6
Residual fuel oil
Road oil
Transformer oil
Aromatic oil (excluding vegetable oil)
Lubricating oils and blending stocks
Mineral Oil
Motor oil
Penetrating oil
Spindle oil
Turbine oil

Distillates
Straight run
Flashed feed stocks

Gas oil
Cracked

Gasoline blending stocks
Alkylates - fuel
Reformates
Polymer - fuel

Gasolines
Casinghead (natural)
Automotive
Aviation
Straight run
Fuel oil no. 1 (Kerosene)
Fuel oil no. 1-D
Fuel oil no.2
Fuel oil no. 2-D

Jet fuels
JP-1 (kerosene)
JP-3
JP-4
JP-5
Turbo fuel
Kerosene
Mineral spirit

Naphtha
Solvent
Petroleum
Heartcut distillate oil

* This list of oils shall not necessarily be considered as comprehensive

Appendices to Annex II of MARPOL 73/78

Appendix I

Guidelines for the categorization of noxious liquid substances

Category A Substances which are bioaccumulated and liable to produce a hazard to aquatic life or human health, or which are highly toxic to aquatic life (as expressed by a Hazard Rating 4, defined by a TLm less than 1 ppm); and additionally certain substances which are moderately toxic to aquatic life (as expressed by a Hazard Rating 3, defined by a TLm of 1 ppm or more, but less than 10 ppm) when particular weight is given to additional factors in the hazard profile or to special characteristics of the substance.

Category B Substances which are bioaccumulated with a short retention of the order on one week or less, or which are liable to produce tainting or the sea food, or which are moderately toxic to aquatic life (as expressed by a Hazard Rating 3, defined by a TLm of 1 ppm or more, but less than 10 ppm); and additionally certain substances which are slightly toxic to aquatic life (as expressed by a Hazard Rating 2, defined by a TLm of 10 ppm or more, but less than 100 ppm) when particular weight is given to additional factors in the hazard profile or to special characteristics of the substance.

Category C Substances which are slightly toxic to aquatic life (as expressed by a Hazard Rating 2, defined by a TLm of 10 ppm or more, but less than 100 ppm); and additionally certain substances which are practically non-toxic to aquatic life (as expressed by a Hazard Rating 1, defined by a TLm or 100 ppm or more, but less than 1,000 ppm) when particular weight is given to additional factors in the hazard profile or to special characteristics of the substance.

Category D Substances which are practically non-toxic to aquatic life (as expressed by a Hazard Rating 1, defined by a TLm of 100 ppm or more, but less than 1,000 ppm); or causing deposits blanketing the sea floor with a high biochemical oxygen demand (BOD); or which are highly hazardous to human health, with an LD_{50} of less than 5 mg/kg; or which produce moderate reduction of...

Appendix

Guidelines for the identification of harmful substances in package form

For the purpose of this Annex, substances identify by any one of the following criteria are harmful substances:

- bioaccumulated to a significant extent and known to produce a hazard to aquatic life or to human health (Hazard Rating "+" in column A*) or
- bioaccumulated with attendant risk to aquatic organisms or to human health with a short retention of the order or one week or less (Hazard Rating "Z" in column A*); or
- liable to produce tainting or seafood (Hazard Rating "T" in column A*); or
- highly toxic to aquatic life, defined by LC50/96 hour ** less than 1 ppm (Hazard Ration "4" in column B*).

---

*Reference is made to the Composite List of Hazard Profiles prepared by the IMO/FAO/UNESCO/WMO/WHO/IAEA/UN/UNEP Joint Group of Experts on the Scientific Aspects of Marine Pollution (GESAMP), which is circulated annually by the Organization by means of BCH circulars to all IMO Member States.

** The concentration of a substance which will, within the specified time (generally 96 hours), kill 50 per cent of the exposed group of test organism. LC_{50} is often specified in mg/l (parts per million (ppm).

USA CRF 40

Protection of Environment

Title 40 is comprised of 22 volumes

Matters related to Solid WASTE is composed of 4 Volumes.

Part	260-265	Solid Wastes
Part	260-299	Solid Wastes
Part	400-424	Effluents and guideline standards
Part	425-699	Effluents and guideline standards

CFR 40
Part 260-265

Definition

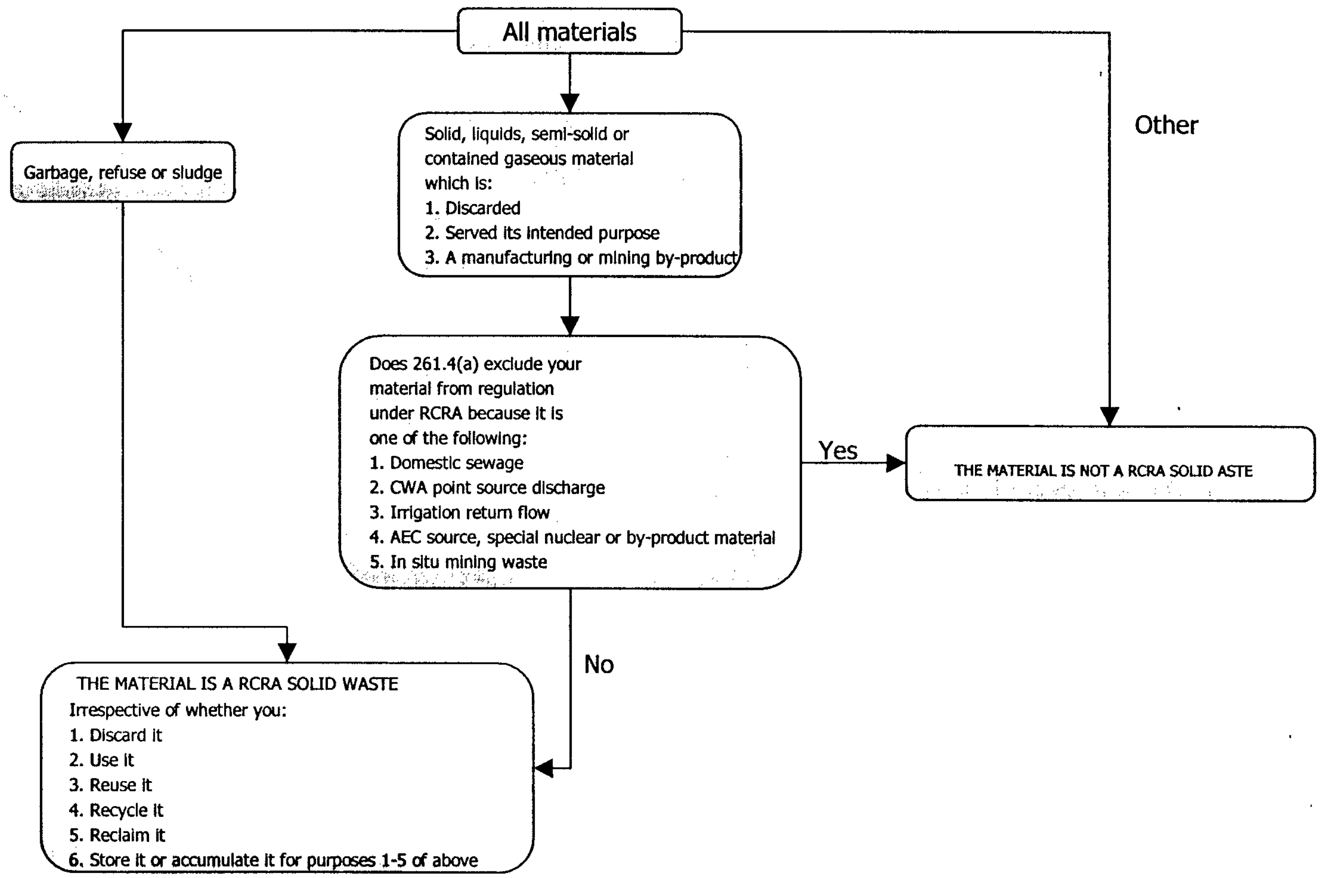
Solid waste means a solid waste defined in 261.2 of the chapter.

261.20: A solid waste is any discarded material that is not exclude by 261.4(a) or that is not excluded by variance under 260.30 and 260.31.

Examples: 260.30 Materials that are accumulated speculatively

260.31 Sufficient material to be transferred for recycled

261.4(a) Domestic sewage



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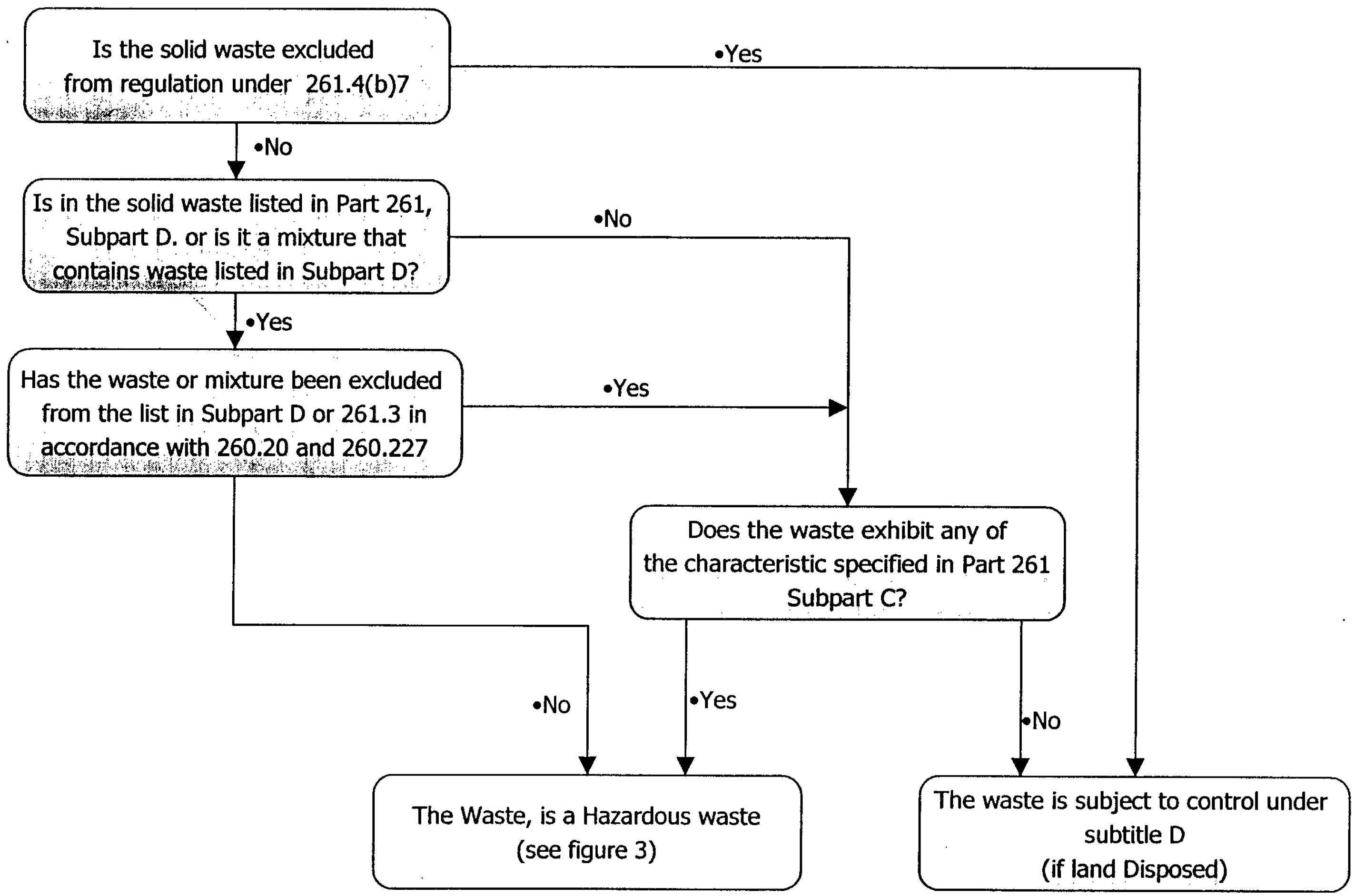
HAZARDOUS WASTE

Definition of Hazardous Waste



REGULATIONS FOR HAZARDOUS WASTE NOT COVERED IN DIAGRAM 3

All Persons who handle hazardous waste subject to control under Subtitle C not covered in figure 3

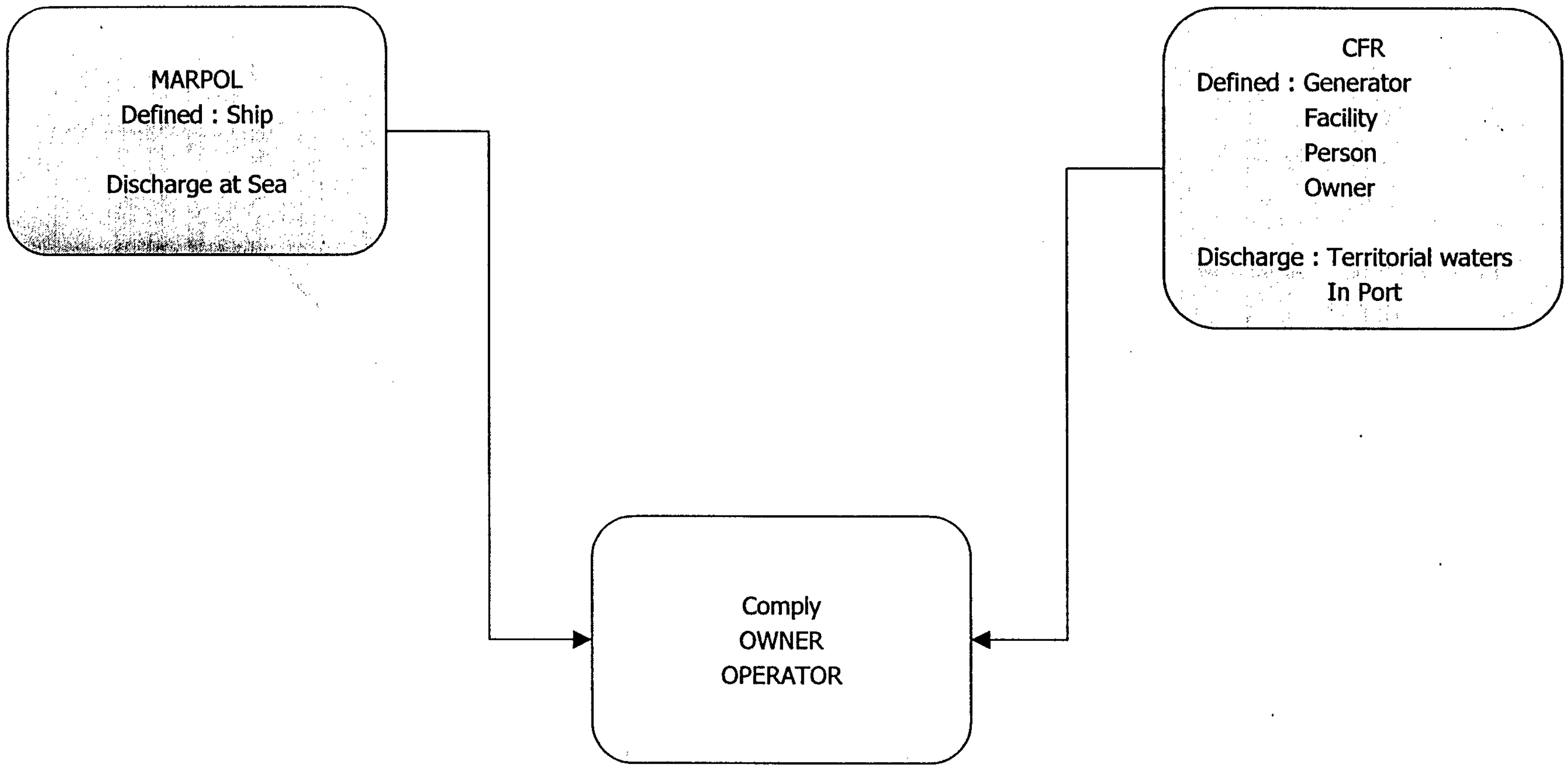
→ Notify EPA according to Section 3010 of RCRA & obtain EPA ID number

- Generators → Part 262
- Transporters → Part 263
- Owners or Operators of T/S/D* Facilities
  - On-Site Generators Storing Wastes < 90 days for subsequent off-site → 262.34 of Part 262
  - All other Owners or Operators
    - O/o** who qualify for interim status → Part 265
    - O/o** who don't qualify for interim status →
      - Stop operation, if any
      - Send waste inventory if any, to a facility whose owner or operator has interim status, or permit, following the part 262 rules.
      - Apply for permit under part 270 & resume or commence operations only after permit is issued by EPA under part 270, 124 and 264, or by a state with EPA-approved hazardous waste permit program.

* T/S/D stands for treatment, storage, or disposal

** O/o stands for Owners or Operators

DEFINITION FOR COMPLIANCE



WASTES FROM SHIPS

Waste General	
Liquid & Semisolid	Fuel oil sludge - Bilge liquids - Sewage Water - Gray Water - Cleaning Compounds - Solvents
	Paint Residues - Cooking Oil
Solids	Cardboard - Aluminum, Metal cans - Crush Glass - Plastics - Empty Lube Oil Drums - Empty Chemical Containers - Engine Filters - Batteries - Photo Films Process Residues - Food - Carpet - Furniture - Wood - Metal Scrap - Expired Pyrotechnics
Gases	Propulsion Engine Exhaust Gases - Aux.. Engine Exhaust Gases - Sewage treatment Plant gases - Boilers Exhaust Gases - Refrigerants
Note:	Food regulated by DOA (Department of Agriculture)

WASTES THAT PRODUCE REVENUE

Cardboard
Aluminum & Metal cans
Crushed Glass
Clear Plastic
Cooking Oil

Revenue Amount 30 - 45% of Total Handling cost

Actual Problems on Waste Handling Marine Equipment

1. Waste Management System was not envisioned until the upcoming of Annex V; However older ships have still more than 10 years of life.
2. Equipment on different technologies are having difficulties such as:
    - Needs for sorting (more personnel to obtain full efficiency).
    - Bulky (Reduce ship space, loss of revenue)
    - Residuals need to be handled manually for disposal ashore.
    - Emission do not comply with local authorities.
    - Redundancy have not been observed.
    - Maintenance and spare parts are very costly.

Vision of Cruise Lines For Waste Management Systems

- Comply with Marpol and local port authorities regulations.
- Built with reduced dimensions.
- Simple to operate and maintain as possible.
- Redundancy on the main components.
- Processing without disposal at sea or in port.

<u>To be</u> disposed <u>or not to be</u> disposed

By Capt. Cornelius de Keyzer

ABSTRACT

A presentation about the state of the affairs in the Port of Rotterdam regarding:

- The existing Port Reception Facilities and figures of the collected volumes of different types of waste during the last decade.
- The recognition that the MARPOL Treaty, aiming at the prevention of pollution of seas and oceans, did not achieve the desired results, especially with regard to a suitable and financeable system of facilities.
- Where social and political intolerance, especially in Europe, has been brought to bear on the problem of marine pollution in the Baltic, Northsea and Mediterranean.
- Due to which the Port of Rotterdam has adopted a pro-active approach, endorsing the view of the European Commission that the general requirement is that the fee system shall provide the incentive for ships to discharge their waste at sea.
- That the "direct" fee system, in which only the users of the facilities pay, is thus in effect excluded, since such a system can never constitute an encouragement for delivery in ports.
- Whereby the Port of Rotterdam is supporting the basic approach of an hybrid fee system for ship generated waste, where all ships substancially contribute to the offered port waste service, regardless disposal or not.

Capt. de Keyzer will highlight and compare the distinguishing characteristics of the proposals of the EC Council Directive, the NO-Special-Fee system of the Baltic and the Hybrid (or combined) fee system as proposed by the Netherlands.

TO BE DISPOSED OR NOT TO BE DISPOSED

Presentation for the Maritime Environment International Conference and Exhibition
"Solid Waste Treatment Technologies for Ships",
ANTWERP, 21 - 23 April 1999

By Capt Cornelius de Keyzer
Senior Policy Advisor
Directorate Shipping
Rotterdam Municipal Port Management

"NAVIGARE NECESSE EST, POLLUENS NAVIGATIO NON EST NECESSE"
(free after Sextus POMPEIUS Magnus)

Ladies and Gentlemen,

In the long ago of the Roman Empire, setting sail for Rome with a full load of grain and heavily storm-beaten, it was Pompeius who launched the device: "Navigare necesse est, vivere non est necesse" or: "Sailing is necessary, living is not necessary". Nowadays and specially today I like to say instead: "Sailing is necessary, polluting when you sail is not".

To achieve this the necessity of a dual approach is recognized in the International Convention for the Prevention of Pollution from Ships, 1973 and the Protocol of 1978 related thereto.

First of all through standards and conditions for discharge of waste, residues and emissions at sea, oceans as well as into the air.
Secondly and next to that by addressing Member States to require their Ports to provide adequate reception facilities according to the needs of the ships, without causing undue delay to ships using these facilities.

To the latter the Port of Rotterdam offers a wide range of adequate reception facilities, thus meeting the obligations of this Marine Pollution, or so called "MARPOL 73/78" Treaty.

At present MARPOL divides ship's waste and emissions into six catagories, each dealing with a different type of pollution. They are described in so called Annexes to MARPOL.

ANNEX I - Mineral oils (from engineroom, cargo and ballast operations)
ANNEX II - Liquid noxious substances carried in bulk
ANNEX III - Harmful substances carried in packaged forms
ANNEX IV - Sewage (sanitary waste)
ANNEX V - Garbage (domestic, maintenance and dry cargo remnants)
ANNEX VI - Air Pollution (including Fuel Oil Quality)

ANNEXES IV and VI are not (yet) in force.

So far Annex IV has been ratified by 73 countries (15 is the minimum) but those countries only represent 42.6 % of the world shipping tonnage (at least 50% is required).

Annex VI - REGULATIONS FOR THE PREVENTION OF AIR POLLUTION FROM SHIPS, is a new Annex to MARPOL, dealing with Ozone Depleting Substances, NOx, SOx and VOC's as well as Fuel Oil Quality and Shipboard Incineration.

After many years of efforts and proposals the MEPC (Marine Environment Protection Committee of IMO) succeeded in achieving global, hence strongly compromised consensus. In November 1997 the text and framework of the Protocol of 1997 and Annex VI to MARPOL 73/78 has been adopted. However it is expected to take several more years to reach the required level of acceptance to enter into force. (At least 15 countries covering 50 % of the world shipping tonnage).

Apart from that future Annexes might become:

[Annex VII] - Harmful Aquatic Organisms in Ballastwater and
[Annex VIII] - Solid Bulk Cargoes and Effluents Containing such Substances

The MEPC of IMO has been addressed to work towards completion of legally binding provisions on ballastwater management in the form of an Annex to MARPOL 73/78.
DRAFT REGULATIONS for the control and management of ship's ballastwater and sediments to minimize the transfer of harmful aquatic organisms and pathogens were launched in May 1998 and further discussed in November 98.
Appendix 1 of this draft, being the Ballastwater Management Code is, inter alia, mentioning practices for Deep Sea Ballastwater exchange and reception and treatment facilities for the environmentally safe disposal of ballasttank sediments.

So far future developments.

The present situation on facilities in Rotterdam is this overview of the total number of designated companies with licenced Port Reception Facilities.

MARPOL CATEGORY	NUMBER	MARPOL CATEGORY	NUMBER	GRAND TOTAL	NUMBER
ANNEX I	11	ANNEX I + II	8	ANNEX I	24
ANNEX II	1	ANNEX I + V	1	ANNEX II	13
ANNEX V	8	ANNEX I + II + V	4	ANNEX V	13
				TOTAL	50

table 1: number of designated companies with licenced PRF's in Rotterdam

These figures include companies involved in the collection, transport, storage, processing and disposal of ship's waste and liquid cargo terminals and ship repair yards.

Overview of the licenced facilities of the designated companies operated by private enterprises.

CATEGORIES	ANNEX I AND/OR II			ANNEX V	
FACILITIES	BARGES	TRUCKS	TANKS	BARGES	TRUCKS
AT CARGO TERMINALS		2	30		
FOR CLEANING & COLLECTION	10 (I&II) 11 (I)				
FOR COLLECTION		76		14	115
AT TREATMENT PLANTS			35		

table 2: licenced Port Reception Facilities operated by private enterprises

Aereal view of Booy Port Services in the Botlek area, a specialized treatment plant with cleaning jetties for both inland and seagoing vessels.

Overview of the transferred quantities in the Port of Rotterdam from 1989- 1998.

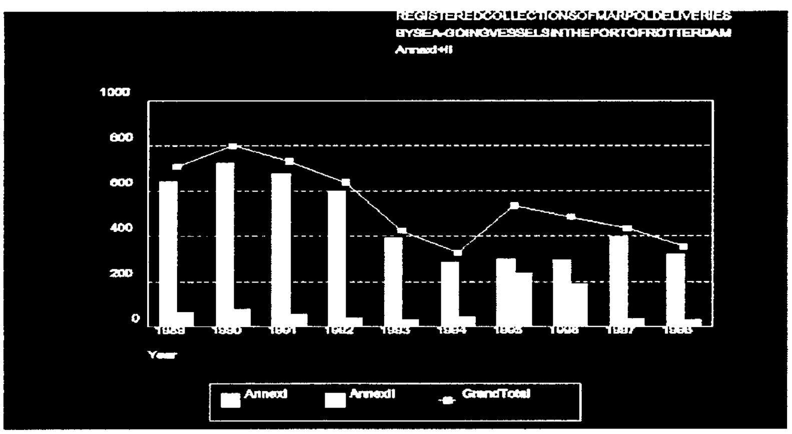


figure 1: registered collections of MARPOL I and II

This diagram shows the totals of registered liquid wastes over the last decade and you see a downward trend of more than 50% until 1994.
The large increase of Annex II in 1995 is caused by the fact that since 1995 slops of edible and vegetable oils have been classified under Annex II Category D, due to the fact that elements of those substances threaten their waterproof feathers and let birds sink. Delivery of residues was stimulated by a promotion project of the Dutch Ministry of Transport which was carried out simultaniously.

This disc diagram is showing it in some other way.

About the exact total number of deliveries, vessels, tanker percentages, registered quantities and Annex II subdivision, you can find more detailed information on page 10 of my conference papers.

Ladies and Gentlemen,

Taking all these facts and figures into consideration, you might draw the conclusion that the situation looks rather good.

Unfortunately, the contrary appears to be reality.

Let's have a look at the Annex V garbage figures. Registered since 1993, they show an average disposal quantity of 13 m^3 per vessel, which looks not so bad. However, despite the fact that the North Sea is a "special area" for Annex V, merely allowing ships the restricted disposal of food waste and no other garbage, only 7 per cent of the ships are discharging their garbage in Rotterdam.
I do not have any figures of other ports to justify the disposal of the remaining 93 per cent.
I will not suggest that the other 93 % is discharging illegally into the sea or did not discharge at other ports but this figure is enough to make us think.

	SEA VESSELS	DISPOSALS	%	QUANTITY	AVERAGE
1993	30758	1817	5,9	18920 m^3	10,4 m^3
1994	30156	2048	6,8	23460 m^3	11,5 m^3
1995	29319	2163	7,4	21515 m^3	9,9 m^3
1996	29416	1948	6,6	26226 m^3	13,5 m^3
1997	29607	2083	7,0	38055 m^3	18,3 m^3
1998*	29551	2113	7,2	29533 m^3	14,0 m^3

table 3: Annex V disposals

Let's also have a look at the Annex I residues resulting from the ship's fuel consumption, the remaining refuse sludge after purifying the fuel oil. Table 4 underneath shows examples of:

a Panamax bulk carrier (65,000 Ts DWT); on a voyage from NOLA - Antwerp,
a Chemical tanker (38,000 Ts DWT); on a voyage from Antwerp - Houston,
a Vehicle carrier (51,000 Ts Gt, cap. 5,000 cars); on a voyage from Pusan - Melbourne,
a 285,000 Ts DWT crude carrier (diesel propulsed); from Kharg Island - Milfordhaven,
a 3rd. generation container vessel (4,000 TEU, 55,000 Ts DWT); from Rotterdam - Singapore,
and a New Post Panamax UCC (6,700 TEU, 89,000 Ts DWT); from Singapore - Rotterdam.

SHIP'S TYPE	SPEED	SAILING DAYS	DAILY CONS.	HFO CONS.	REFUSE %	TOTAL SLUDGE	PER DAY
Bulkcarrier	14'	14	35 Ts	490	2,00	9,8 Ts	0,7 Ts
Chemical Tanker	15,5'	14	50 Ts	700	1,75	12,3 Ts	0,9 Ts
Vehicle Carrier	19,5'	11	60,5 Ts	665,5	2,00	13,3 Ts	1,2 Ts
VLCC	14'	36	100 Ts	3600	1,75	63,0 Ts	1,8 Ts
Containership	23'	17	165 Ts	2805	1,50	42,1 Ts	2,5 Ts
New Post Panamax	24,5'	16	270 Ts	4320	2,00	86,4 Ts	5,4 Ts

table 4: fuel consumption/refuse sludge production

Because the estimation of the annual global HFO consumption by ships is some 110 million tons (low side estimation for 1996, source BP/Cockett), the annual global refuse sludge production is estimated to be at least 2.2 million tons, apart from the MDO refuse.
Next to that ships produce large amounts of lubrication oil waste and other E.R. oily waste substances. Compared to the disposal figures at Rotterdam shown in table 5, it is obvious that only a limited number of ships are disposing small quantities of this engine room generated waste.

	SEA VESSELS	DISPOSALS	%	QUANTITY	AVERAGE
1993	30758	572	1,9	17174 m^3	30,0 m^3
1994	30156	694	2,3	14923 m^3	21,5 m^3
1995	29319	742	2,5	14238 m^3	19,2 m^3
1996	29416	805	2,7	22847 m^3	28,4 m^3
1997	29607	916	3,1	42956 m^3	46,9 m^3
1998*	29551	1000	3,4	18931 m^3	18,9 m^3

table 5: fuel refuse/sludge

As you can see, there was an increase but the percentage and quantities are still very low.

One might say that this is because ships are equipped with incinerators but it is neither compulsory to have one, nor is there an obligation to use one if there is an incinerator on board.
Apart from that it is known that incinerators often function badly and cause unwanted air pollution.
Of course it must be said that there are "really good" shipowners but we also have to face the fact that there are "other" shipowners. Anyhow, burning 2,5 up to 5,4 Ts fuel sludge per day is quite a lot.

So far Annex I oil refuse.

With regard to Annex I cargo slops or dirty ballast, we have been informed that at some cargo terminals hardly any quantities are transferred, with the result that some existing storage tanks not have been used for a few years.

Furthermore, we face the fact that at this moment, only some 25 per cent of the treatment capacity in Rotterdam is in use for ship's waste. However, the treatment plants manage to survive, because nowadays the processing of industrial waste streams became their core business.

And last but not least, we are regularly faced with the visible results of on-going legal or illegal pollution by ships, in spite of the existing regulations. Just think of the reports through the media concerning oil slicks at sea, polluted beaches et cetera.

Ladies and Gentlemen,

All these facts and figures, together with the present direct financing system for ship's waste emphasize that neither the MARPOL rules, nor the provision of Port Reception Facilities,
as implemented in national laws, improved the situation sufficiently during the last decade.
Summarizing one and another my conclusion is that aunt MARPOL has become an old lady.

I admit she is still respectable and not that unmanageable as my mother in law,
but at least she needs to be upgraded substancial by a couple of face lifts.

Moreover the general feeling of dissatisfaction caused a growing social and political pressure to improve the situation. As examples I mention :

- The proclaimed concerted actions as stated in the Ministerial Declaration of the 4th International Conference on the Protection of the North Sea in November 1995.

- The decision of the European Commission to include the subject on its legislative programme for 1998 and consequently the preparation for the recently issued:
PROPOSAL FOR A COUNCIL DIRECTIVE ON PORT RECEPTION FACILITIES FOR SHIP-GENERATED WASTE AND CARGO RESIDUES.

- Next to that a policy statement of ESPO (European Sea Ports Organisation), which ,inter alia, considers mandatory discharge to be a useful weapon in requiring ships to account for their waste and apart from that:

- The recognation of the world port community, reflected in the endorsement of a position paper at the biannual conference of IAPH (International Association of Ports and Harbors) in London last year and IAPH's continued efforts to raise awareness of ports on this matter.

In order to be able to provide a constructive and structural contribution to the discussions, the Port of Rotterdam decided on a pro-active approach and produced a policy guideline in 1996, approved by the city council, of which I want to point out the headlines.

(For a detailed outline, I refer to the Policy Guidelines in my conference papers on pages 11 & 12.)

Hereby, I want to underline that our approach not necessarily has to match the views of the Ministry of Transport of the Netherlands. It is true that the Rotterdam Municipal Port Management is on a lower administration level than the Ministry, but on the other hand, I must say (and I quote one of our former aldermen) that "The Port of Rotterdam is the **only** Dutch municipal **multinational**".

Ladies and Gentlemen,

To achieve an acceptable situation in the future for Europe or at least part of that, we in Rotterdam have promoted the following approach:

MAIN PRINCIPLE'S:

WHEN ADDRESSING RECEPTION, TREATMENT AND FINANCING OF SHIP'S WASTE, ABANDON THE PRESENT MARPOL CATEGORIZATION AND MAKE A STRICT DISTINCTION BETWEEN SHIP GENERATED WASTE AND CARGO RELATED WASTE.
(Because the present Marpol Annex classification is workable at sea to prevent pollution but certainly not when it comes to reception, treatment and financing ashore).

MAINTAIN THE MARPOL APPROACH FOR CARGO RELATED WASTE AND LEAVE THE FINANCIAL ASPECTS TO THE CARGO INTERESTS. DISPOSAL REGIME FOR SUBSTANCES AS REQUIRED BY MARPOL AND BASED UPON DIRECT FINANCING.

INTRODUCE MANDATORY DISPOSAL FOR SHIP GENERATED WASTE TOGETHER WITH A UNIFIED INDIRECT FINANCING SYSTEM BASED ON SHIP'S CHARACTERISTICS AND INTRODUCE THE PRINCIPLE OF A TOTAL BAN ON DISCHARGE FOR THE NORTH SEA. PRECONDITIONS:

- A LEVEL PLAYING FIELD BETWEEN COMPETING PORTS
- AN EFFECTIVE INFORMATION AND COMMUNICATION SYSTEM BETWEEN PORTS
- FINANCING THROUGH EUROPEANWIDE FUNDING AND REFUNDING PER REGION (preferably after or together with the introduction of the EuroCoin)

So far our basic contemplation and attempt to achieve an acceptable situation, which triggered the dialogue with the Ministry of Transport of the Netherlands because they were busy in producing an Environmental Policy Plan for Shipping and facing the problem that The Netherlands ratified the MARPOL Treaty as Member State, Flag State and Port State, thus agreeing with the Marpol approach which was now considerably critisized through the Policy Guidelines of the Rotterdam Municipal Port Management including the City Council.
Apart from that but at the same time both the Ministry of Transport and the Ministry of Environment were heavily involved in the aftermath of the so called TCR affair, one of the biggest environmental scandals in the Dutch history. (A 23 million guilders contribution for the set up of a proper treatment facility disappeared, creating a lot of illegal pollution and leaving behind a huge amount of severely contaminated chemical substances).
To learn from this a high level interdepartemental committee was commissioned to produce recommendations for a good working and verifiable system to prevent any possible future repetition.

Finally all these actions resulted in a number of recommendations, among which the proposal for a so called HYBRID or COMBINED FEE system, consisting of two elements, an indirect fee and a variable fee for ship-generated waste, being:

- The indirect fee for <u>all</u> ships entering the port, irrespective of actual use of the facilities.
  The fee should be based on the different ship's characteristics.
  This indirect fee will cover the costs for infrastructure and provided service, inclusive a certain basic part of the treatment costs.

- The variable and thus direct fee for the remaining treatment costs of the actual amount of waste a vessel is discharging, being calculated according amount and type of waste.

  It will be evident that these costs will be much less compared to the current direct fee system and will lead to a substantial reduction of the total costs of disposal for individual ships.

Of course the HYBRID FEE system must reflect a good balance between both elements.
The indirect fee is encouraging shipowners to use the available service because whether they use it or not they pay for it anyhow.
On the other hand the surcharge should not be too high, because it might entail a financial incentive for the "other" shipowner not to dispose at all.

An undeniable advantage compared to a straight indirect fee system is that the HYBRID FEE system, being still in line with the principle "the polluter pays", still creates a clear financial incentive for "good" behaviour i.e. for those ships that through practising good housekeeping and environmental management produce less waste and therefore are able to reduce the costs for disposal.
Anyhow it is expected that this HYBRID or COMBINED FEE system, in combination with higher service standards, better enforcement procedures and the introduction of the principle of mandatory delivery for ship-generated waste, will be a useful approach to achieve an acceptable situation in the future.
THE NO-SPECIAL-FEE SYSTEM in the Baltic Sea Area

HELCOM (Helsinki Commission) Recommendation
Helsinki Convention 1992. Adopted in March 1998.
To be applied per 1-1-2000.

10 Distinguishing characteristics:

Harmonized indirect fee system for the Baltic for every sea-going ship at any port
Fee covers collecting, handling and processing including infrastructure
Fee only covering oily wastes from machinery spaces of ships according MARPOL Annex I
Fee included in the Harbour Dues irrespective waste delivery or not
Exemptions possible for dedicated trade with waste contracts
Waste management fee independent of the volume discharged
Basis of calculation is the Gross Tonnage
Scaling adjustment possible for high quality standard waste management
Fee to be transparant to all ships
Right for ships to claim disposal of her oily wastes from E.R. at no extra costs

EC COUNCIL DIRECTIVE PROPOSAL of 17.07.1998
Approved .... ?
To be applied per .... ?

12 Distinguishing characteristics:

The directive shall apply to all ships in all ports of the member states
Waste reception and handling plan to be implemented in each port
Information with 24 hours notification prior to arrival
Mandatory delivery of ship-generated waste according MARPOL Annex I & Annex V
Mandatory indirect fee or combined fee for all ships
Fee calculation on base of the category and size of the ship
Reduction on fee possible for environmental friendly ships producing less waste
Transparancy of fees required
Exemptions possible for scheduled traffic with regular port calls
Target control and inspection procedures
Possibility to ensure that vessels do not leave the port until waste has been delivered
Information for next port of call with regard to non complying vessels.

Ladies and Gentlemen,

One way or the other, all these approaches either regional or for the whole of Europe ultimately will lead to an acceptable situation for the environment.

For you to choose the best option for your own benefit and future, whatever approach you prefer. Moreover, even when you have no approach at all you have to choose one.

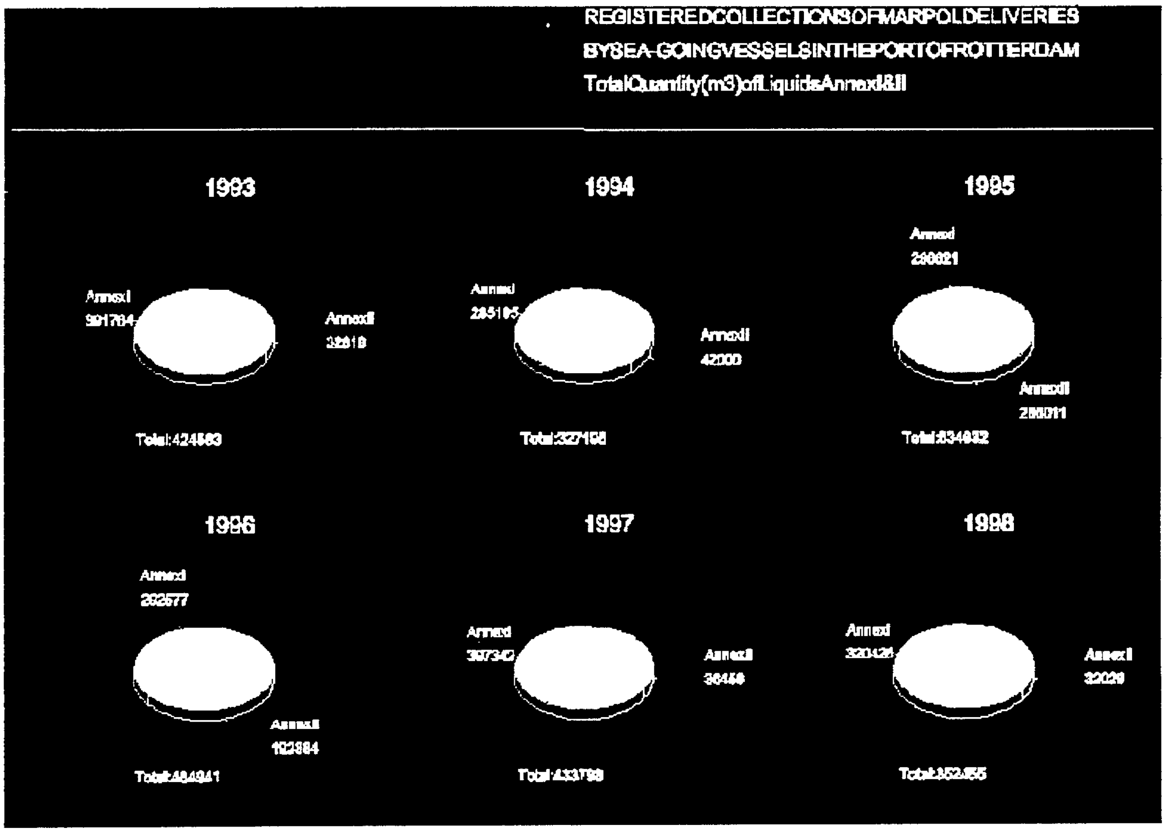
In 1991, the Rotterdam Municipal Port Management proclaimed:

"ONLY A CLEAN AND SAFE PORT WILL SURVIVE"

In line with that I advance the thesis:

"ONLY A CLEAN AND SAFE NORTH SEA WILL SURVIVE"

Ladies and Gentlemen,
Here ends my presentation, thank you all for your attention.


REGISTERED COLLECTIONS OF MARPOL DELIVERIES
BY SEA-GOING VESSELS IN THE PORT OF ROTTERDAM
Total Quantity (m3) of Liquids Annex I & II
1993
1994
1995
1996
1997
1998
Annex II
42000

PORT OF ROTTERDAM RECORDS 1989 - 1998

Year	Arrival of sea-going vessels	of which tankers	%	Annex I Registered Collections		Annex II Registered Collections		Total Registered Collections	
				#	Quantity (m^3)	#	Quantity (m^3)	#	Quantity (m^3)
1989	31330	6689	21	1580	642745	293	65895	1873	708640
1990	32169	6213	19	1848	723917	306	76073	2154	799990
1991	33416	6400	19	2089	678966	398	54772	2487	733738
1992	32274	6061	19	1846	599989	370	38731	2216	638720
1993	30758	5495	18	1581	391764	296	32819	1877	424583
1994	30156	5709	19	1834	285195	395	42000	2223	327195
1995	29319	5546	19	1837	298621	593	236011	2430	534632
1996	29416	5871	20	1750	292577	519	192364	2269	484941
1997	29607	5919	20	1903	397342	425	36456	2328	433798
1998*	29551	5768	20	2064	320426	404	32029	2468	352455

SUBDIVISION OF ANNEX II CATEGORIES

	1998*		1997		1996		1995		1994		1993		1992		1991	
	#	Q'ty	#	Q'ty	#	Q'ty	#	Q'ty	#	Q'ty	#	Q'ty	#	Q'ty	#	Q'ty
Cat.A	179	5637	163	6859	161	7837	165	4913	98	2321	77	1679	77	3954	70	1637
Cat.B	54	2048	68	2198	68	4264	78	5861	75	4660	80	8287	96	9425	107	14871
Cat.C	121	7350	145	10141	209	23531	250	20791	148	9778	76	5522	138	6929	140	6912
Cat.D	43	16304	35	16096	67	153677	79	201895	56	22606	50	14906	44	16329	61	28871
App.III	7	690	14	1162	14	3054	21	2551	18	2635	13	2425	15	2094	20	2481
Total	404	32029	425	36456	519	192364	593	236011	395	42000	296	32819	370	38731	398	54772

MARPOL Reception Facilities

Policy Guidelines of the
Rotterdam Municipal Port Management (RMPM)

1. Social and political tolerance towards pollution of the marine environment is diminishing in a rapid pace.

2. The existing instrument, the MARPOL 73/78 Convention, has not brought the expected results; the seas have not or only marginally become cleaner and legal and illegal discharges of polluting substances are the order of the day.

3. There is a general view that the 'failure' of the MARPOL treaty is related to the existing system of port reception of ship's wastes. Not surprisingly, there is a growing interest of national, European and international authorities for the operation and financing of these reception facilities.

4. In view of the increased attention for the matter, and the fact that several authorities at various levels are contemplating the development of amended and new regulations, it is adamant for the RMPM to actively participate in the ongoing discussions with the aim to protect its interests at the same time pursuing the goal of improved discharge behaviour by ships.

5. Participation in the discussions requires the development of a clear policy on the matter as well as the formulation of a number of pre-conditions which need to be met when the policy is implemented.

6. New regulations should preferably be on an European basis. If this appears not to be possible for practical reasons, regional solutions should be developed. The regions should be so delineated that they comprise all ports which are in competition which each other (i.e. Baltic, North Sea and Mediterranean).

7. The regulations should ensure a level playing field (per region). This means equal costs to shipping in identical cases.

8. In case of a generic system of financing, this should comprise a (yet to be determined) equal levy per ship, irrespective of the presence of reception facilities in that port. The generated funds should be channelled to an European (regional) facility which should divide them over the reception and treatment facilities.

9. The following basic policy elements apply:

9.1. Where it concerns the reception and treatment of ship's wastes the MARPOL categorization should be abandoned. Instead a division should be made between ship related waste and cargo related waste.

9.2. Ship related waste is waste which results from the operation of the ship (mainly wastes from the engine room, domestic waste, sanitary waste and maintenance waste).

9.3. Cargo related waste is waste which results from the carriage and handling of dry or wet bulk cargoes.

The financial aspects regarding discharging and treatment of this category should be left to the cargo interests. The port will only ensure that the proper procedures are followed when these wastes are discharged and that the final treatment is carried out by an authorized installation. Discharge is only necessary when required by MARPOL.

10. For ship related waste the following policy should be established:

10.1. Wastes from the engine room: compulsory discharge and a system of (yet to be developed) indirect financing.

10.2. Domestic wastes: compulsory discharge and indirect financing, i.e. based on the number of persons on board.

10.3. Sanitary waste (sewage): this part of MARPOL has not entered into force, consequently no policy is required at this stage.

10.4. Maintenance waste: yet to be developed.

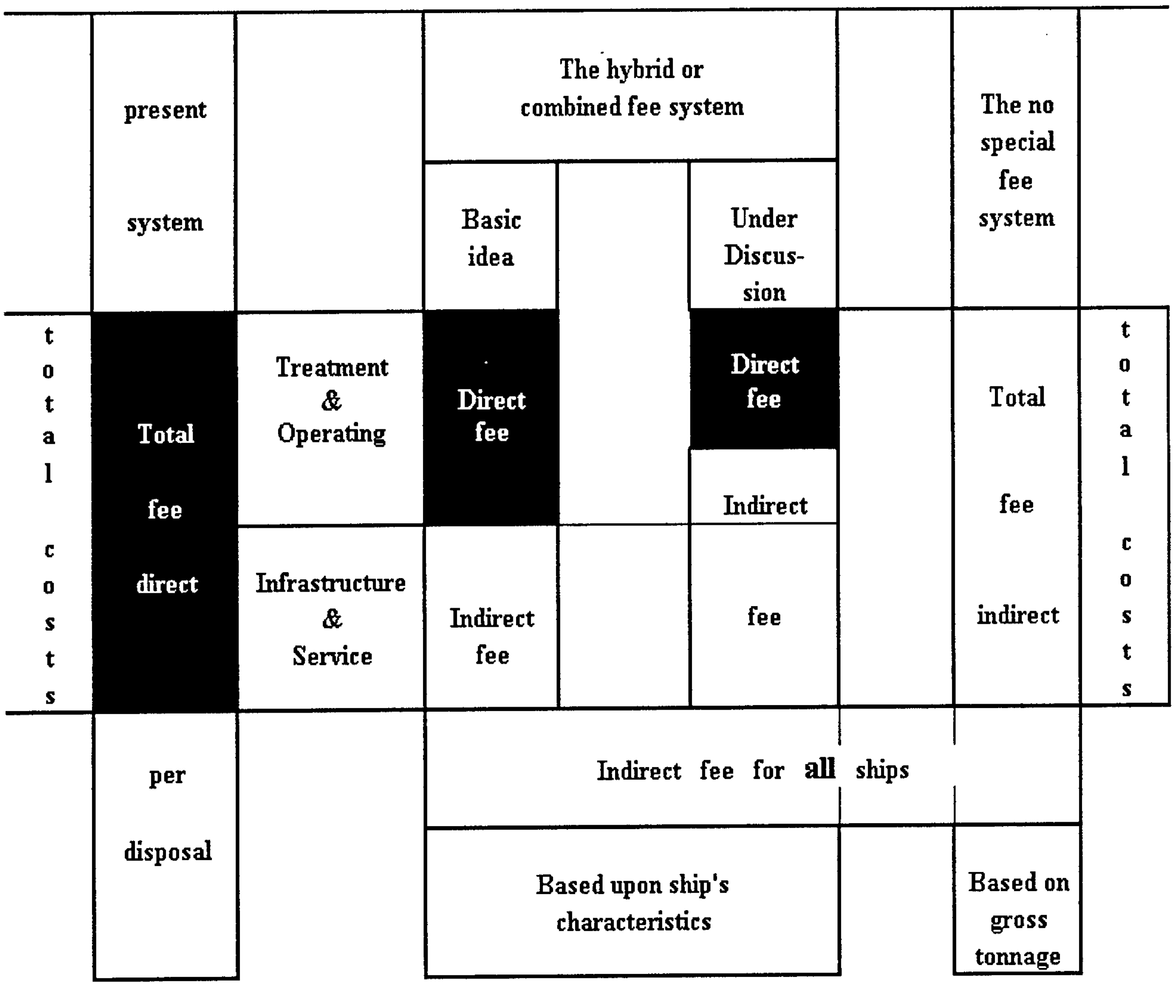
11. Introduce the principle of a total ban on discharge (for the North Sea)

Note 1: The above concerns the principles of the policy. It will be clear that exceptions will be required for ships which sail at high frequencies such as ferries. This need to be studied on a case by case basis.

Note 2: The financing system should preferably be set up in such a way that it encourages waste minimalisation on board.

Note 3: The system should enable rewarding environmentally friendly behaviour.

C.V. CORNELIUS DE KEYZER, MASTER MARINER.
Capt De Keyzer has been involved in the shipping business for 35 years. After graduating from the Nautical Academy Rotterdam he joined the Holland America Line as a junior deck officer. After a career of 11 years in the Dutch, Liberian and Canadian merchant marine he signed off and joined Furness Shipping and Agency as marine cargo superintendent and liner manager. In 1974 he exchanged private enterprise for public service and was 13 years involved in vessel traffic- and portcontrol management at Pilot Maas, Europoort and the Harbour Co-ordination Centre respectively. From 1987 - 1991 he was appointed as sector Harbourmaster of the Left Bank area of the Port of Rotterdam, after which he switched over from operational to policy management as (senior) advisor Nautical, Safety & Environmental policy for the Directorate Shipping of the Rotterdam Municipal Port Management. Capt De Keyzer is also assigned as bunkerco-ordinator for the RMPM. In 1996 he has been elected as councillor of the IBIA, the International Bunker Industry Association.


present system
The hybrid or combined fee system
The no special fee system
Basic idea
Under Discus-sion
total costs
Total fee direct
Treatment & Operating
Direct fee
Direct fee
Total
Indirect
fee
indirect
total costs
Infrastructure & Service
Indirect fee
fee
per disposal
Indirect fee for all ships
Based upon ship's characteristics
Based on gross tonnage

• The Maritime Environment •

"Solid Waste Treatment Technologies for Ships"

Session 2

Thermal Waste Treatment Technologies

Session Chairman: Mr. Klaus Altenberg, DEERBERG SYSTEMS, GE

2SESSION.DOC

Session 2– Thermal Waste Treatment Technologies

Mr. Claus Altenberg, from DEERBERG-SYSTEMS, GE.

He graduated from the University of Lübeck as a Diplom Engineer in 1975.

He started his industrial career at the Seebeck Yard in the department "Special Mechanical Engineering".

Since 1987 he cooperated with DEERBERG-SYSTEMS in the development and design of Incineration Systems for passenger vessels. In 1992 followed the design of the first incinerator with a moving grate under the philosophy "no sorting of waste on board ships".

In 1999 he joined DEERBERG-SYSTEMS and is responsible for the Project and Design Department.

He will now take the chair for session 2 and present his lead in paper on

Thermal Waste Treament – Yesterday, Today, Tomorrow

Paper 2: Dr. Richard D. Eschenbach, RETECH Services, Inc., US

The following paper has been written by Mr. Bruce D. Sartwell, Surface Chemistry Branch (Code 6170), Naval Research Laboratory, Washington, DC. and Fred H. Gehrman, Capt., USN (Ret.), Director of Programs, Retech, Inc. Ukiah, CA.

Capt. Gehrman was foreseen as the presenter of the paper, unfortunately he cannot be with us. Therefore, Dr. Richard D. Eschenbach from Retech Services will present the paper titled

Development of a Plasma Arc System for the Destruction of US Department of Defence Hazardous Waste

Paper 3: Dr. Igor Vodyanoy, U.S. Navy, Office Naval Research, UK

The author of paper 3 on Waste Management aboard Ships using Advanced Incinerator Technologyin this session Mr. Jörgen Kyed from TeamTech, NO, has fallen sick. He cannot present his paper. We do regret that very much. We like to wish Mr. Kyed a good recovery from the operations which he to undergo and good health for the future.

Dr. Vodyanoy will now present the paper of Mr. Kyed.

Paper 4: Howard M. Clarke, Morgan Automation, UK

I like to introduce Mr. Howard M. Clarke from Morgan Automation, UK.

He graduated from the University of Wales, UK, in 1961 and worked subsequently for some years in the area of instrument development for ICI and the UK Steel Industry. Since 1972 he has worked in his own company and has often been working at the forefront of technology and adchieving several notable firsts.
He developed the first 7 KV DC transistorised Amplifier now widely used in the chines industry, a unique anthropomorphic industrial robot, telephone-controled lighting systems and several novel surgical machines. He presently sits on Department of Trade and Industry Foresight Committee.

His envolvement in the development of clinical waste management systems also led to what he now wants to present his about

Facilities for Women at Sea – Development of an Onboard Treatment System for Female Sanitary Waste

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S2P1-PICT01.JPG

DEERBERG
SYSTEMS

THERMAL WASTE TREATMENT

YESTERDAY, TODAY AND TOMORROW

THE OCEANS ARE OUR GLOBAL COMMONS

LECTURE GIVEN BY

CLAUS ALTENBERG
HEAD OF TECHNICAL DEPT.

AT THE INTERNATIONAL CONFERENCE AND EXHIBITION
„SOLID WASTE TREATMENT TECHNOLOGIES FOR SHIPS"

ANTWERP, CROWNE PLAZA, APRIL 21, 1999

Since 1756 the Deerberg Family has supplied Quality in Tradition

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DEERBERG SYSTEMS

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DEERBERG SYSTEMS

1. INTRUDUCTION

Because of its varying composition, on board accumulated waste is a combustion product of inhomogeneous mixture.

Dependent of its inhomogeneous mixture the intensity of combustion changes constantly because of different amounts of calorific values (see fig. no. 1 and 2) .

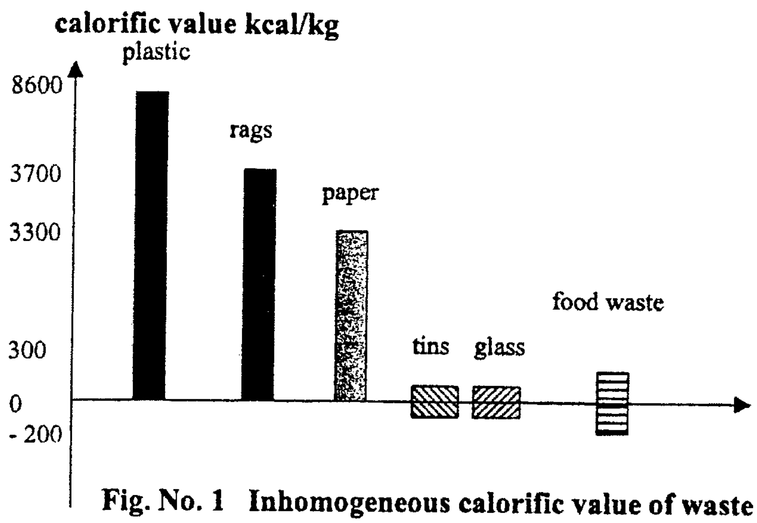

Fig. No. 1 Inhomogeneous calorific value of waste products

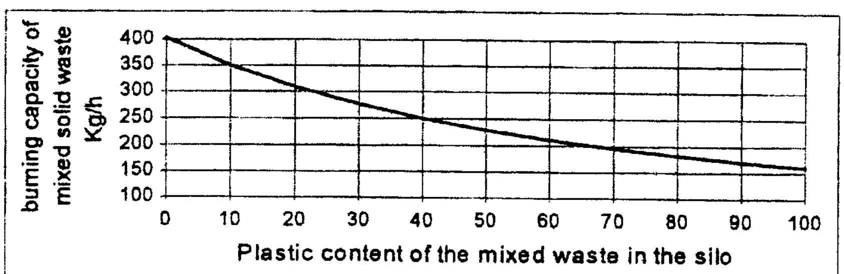

Fig. No. 2 Burning capacity dependent of the content of plastic

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DEERBERG SYSTEMS

1.1 Daily amount of accumulated waste per person on board

• **Burnable Waste**	**1,2 kg**
- **Cardboard**	
- **Paper**	
- **Rags**	
- **Plastic**	
• **Glass**	**0,6 kg**
• **Tins**	**0,1 kg**
• **Food Waste**	**1,4 kg**
Total	**3,3 kg**

1.2 Example for an Cruise Liner with 3100 peoples on board

• **Burnable Waste**	**3720 kg/ day**
• **Glass**	**1860 kg/ day**
• **Tins**	**310 kg/ day**
• **Food Waste**	**4340 kg/ day**
Total	**10230 kg/ day**

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04

2. THERMAL WASTE TREATMENT - YESTERDAY -

The basic of design for the first incineration systems was the combustion of burnable waste only (see fig. no. 2).

Result: Manually sorting out of all different types of burnable waste and non burnable waste.

Disadvantages

- **Increased labour costs for sorting out works**
- **Additional components necessary for processing of the non burnable waste**
- **Extremely unhygenically work during sorting out**
(see fig. no. 3)
- **No guarantee that plastic is not discharged over board**
(see fig. no. 4)
- **Additional cooled down area for storage of non burnable waste**
- **Risk of growing up of bacterias**
- **Export of bacterias to foreign countries**
- **No fulfillment of future stricter rules and regulations**

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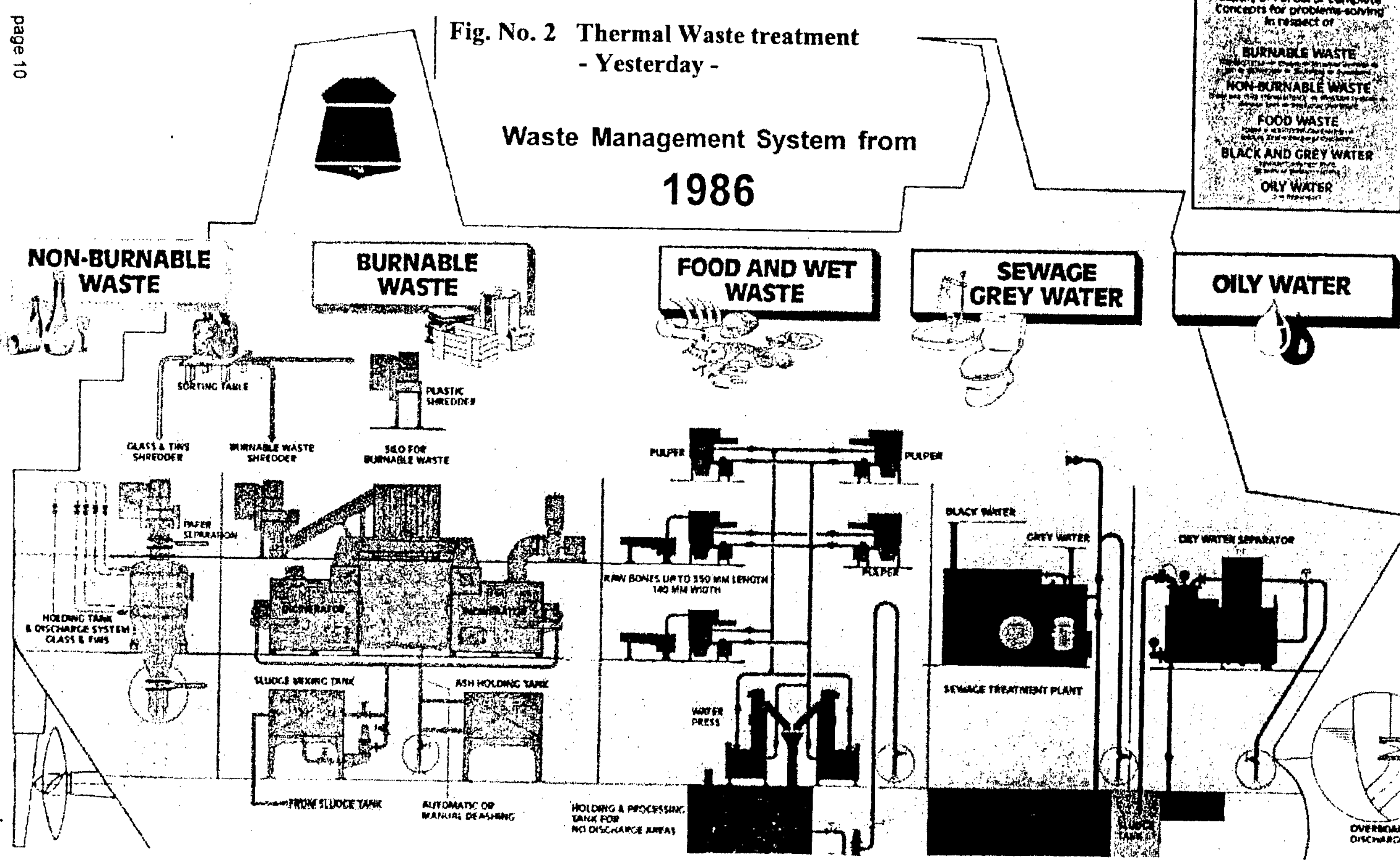
TOTAL WASTE TREATMENT CONCEPT FOR CRUISE LINERS AND FERRIES



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06

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<u>Fig. No. 3</u>
Unhygenically work during sorting of garbage on board

<u>Fig. No. 4</u>
Typical composition of food waste inside a pulper drum (Food waste /plastic mixture)

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07

2.1 Design of the Incinerator

- **2 Chamber type** (see fig. no. 5)

  - 1st Chamber = Combustion Chamber

  - 2nd Chamber = Post Combustion Chamber

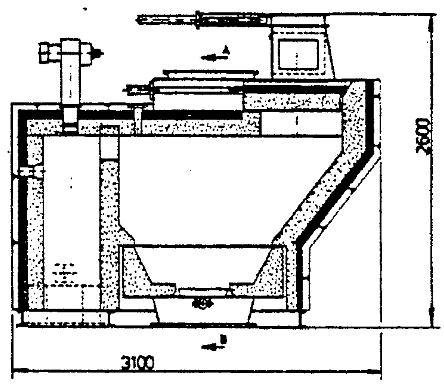

Fig. No. 5 2 Chamber Incinerator

- **Grate System** (see fig. no. 6)

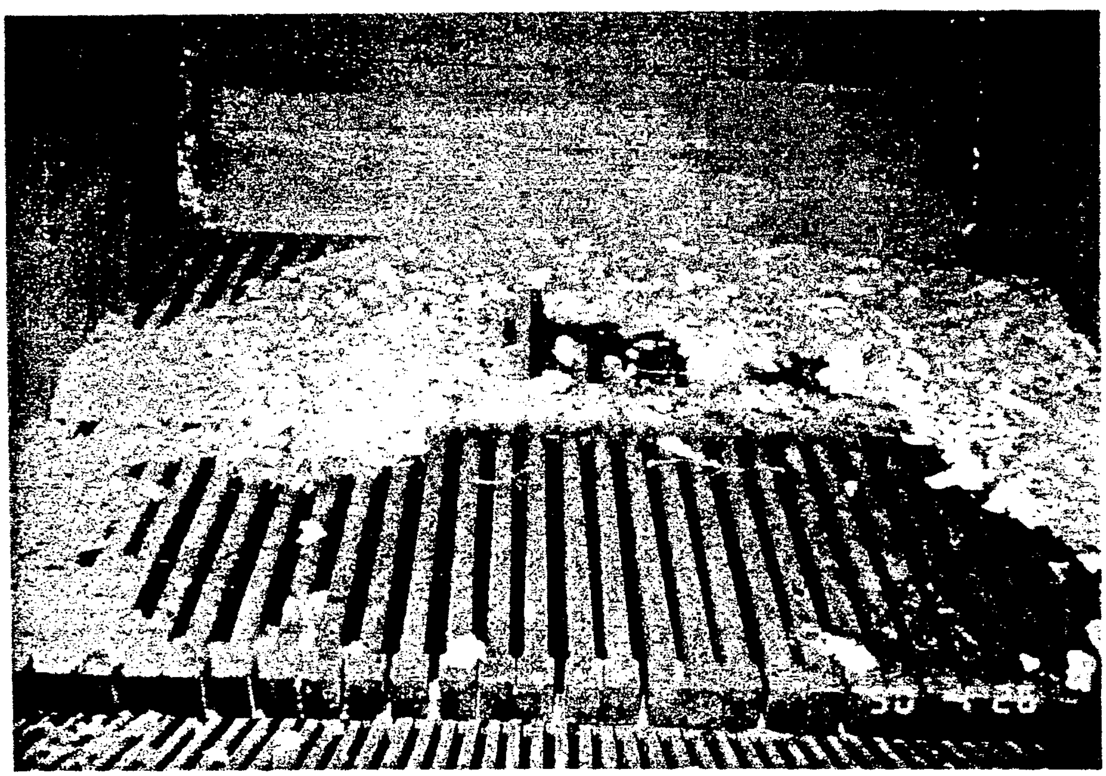

Fig. No. 6 Grate System for handling Burnable Waste only

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- **De-Ashing** (see fig. no. 7)

  De-ashing process out of the incinerator into the ash holding tank.

  - **Ash holding tank filled with water**
  - **Ash and water mixed by a stirrer**
  - **Discharge of ash-water-mixture over board by special pumps**

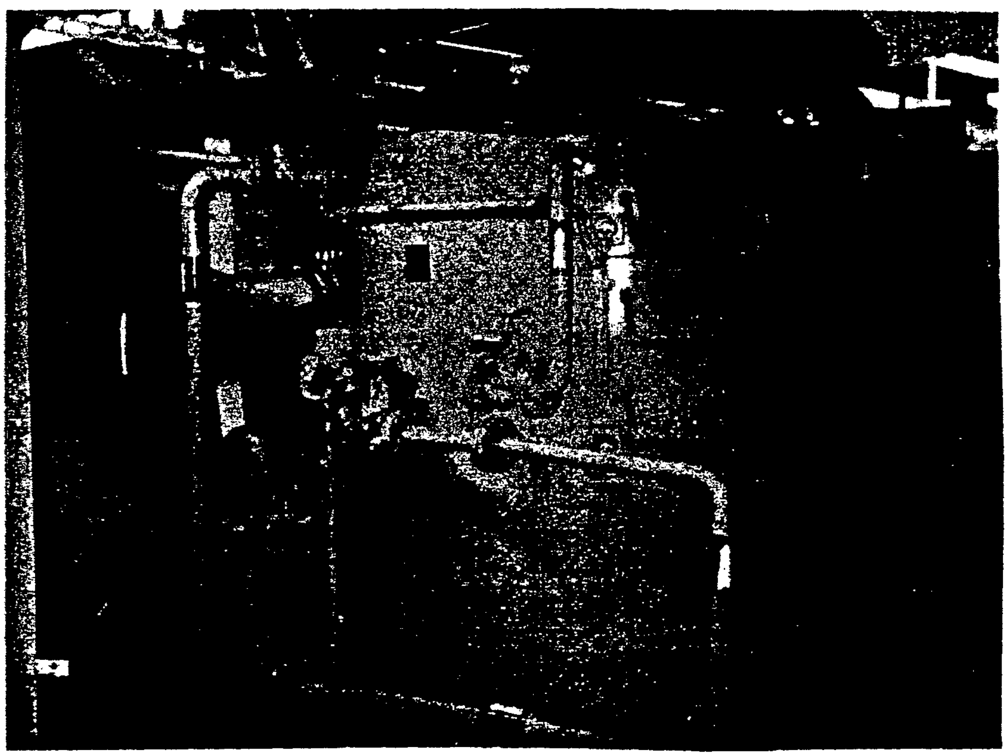

Fig. Nr. 7 Ash Holding Tank

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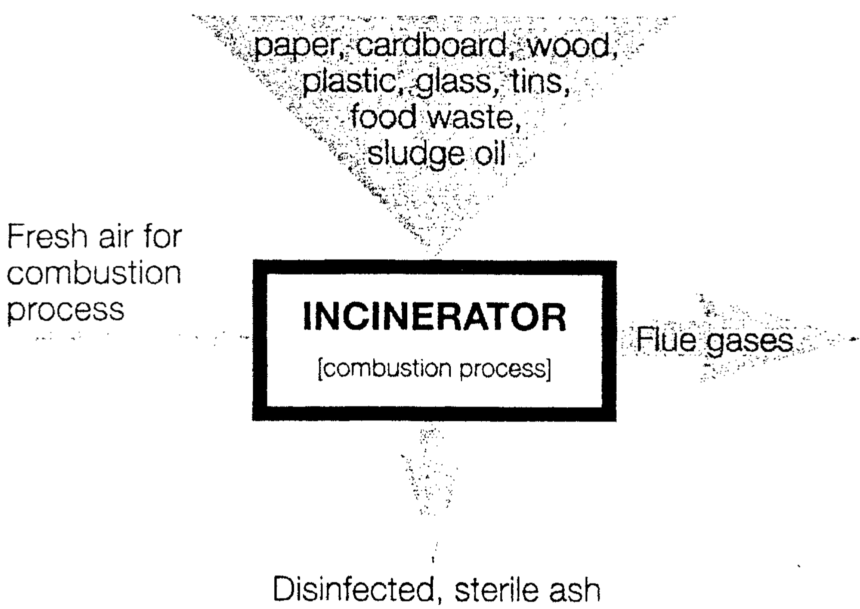
3. THERMAL WASTE TREATMENT - TODAY -

To fulfill all rules and regulations and to guarantee a simple waste handling, an INCINERATOR installed on board must be in an position to incinerate all different types of unsorted waste to an optimum with the result of:

- **Minimum of Flue Gas Emissions**

and

- **Non Hazardous (Hygienically Harmless) Ash**



Conclusion

The Waste Management System on board must be a Non Sorting System
(see fig. no. 8 and 9)

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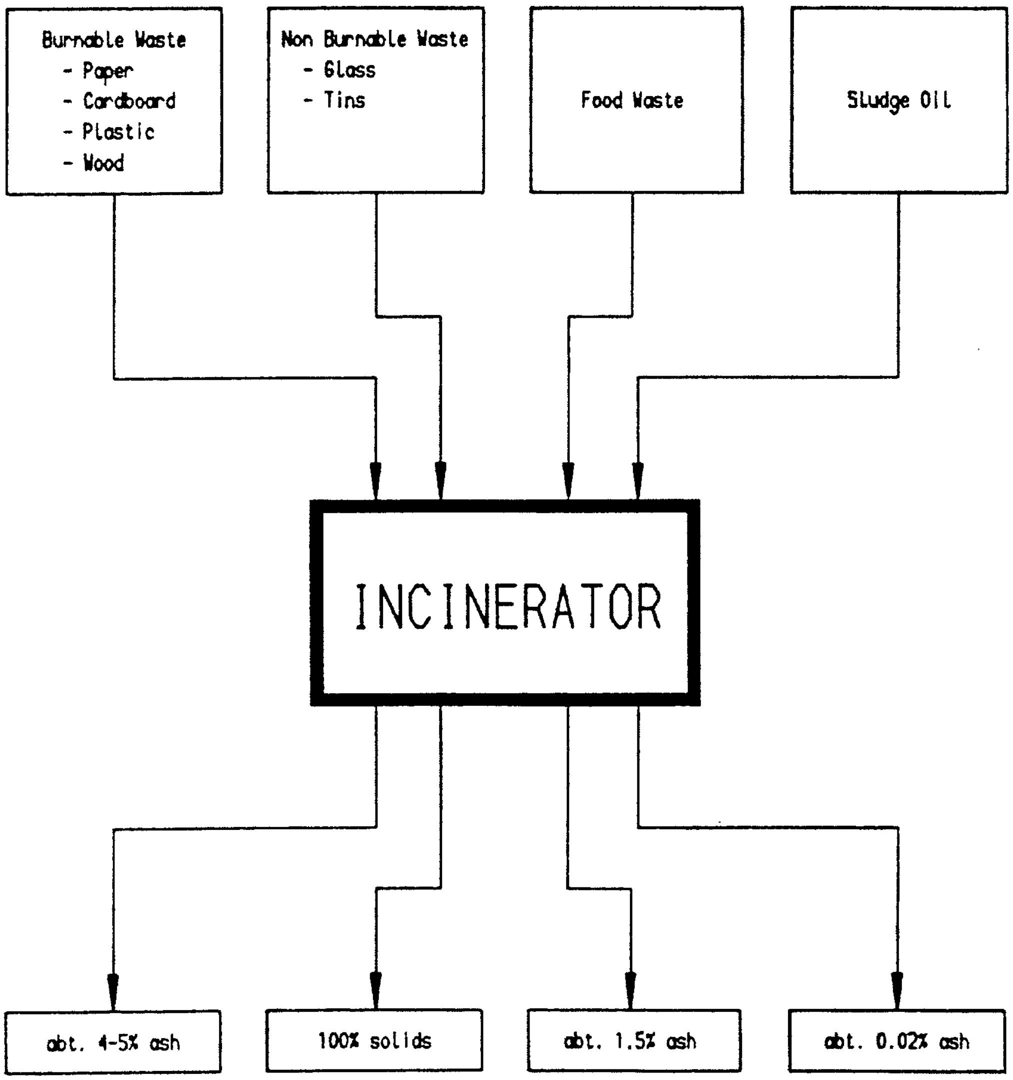

Fig. No. 8 Non Sorting Incineration System

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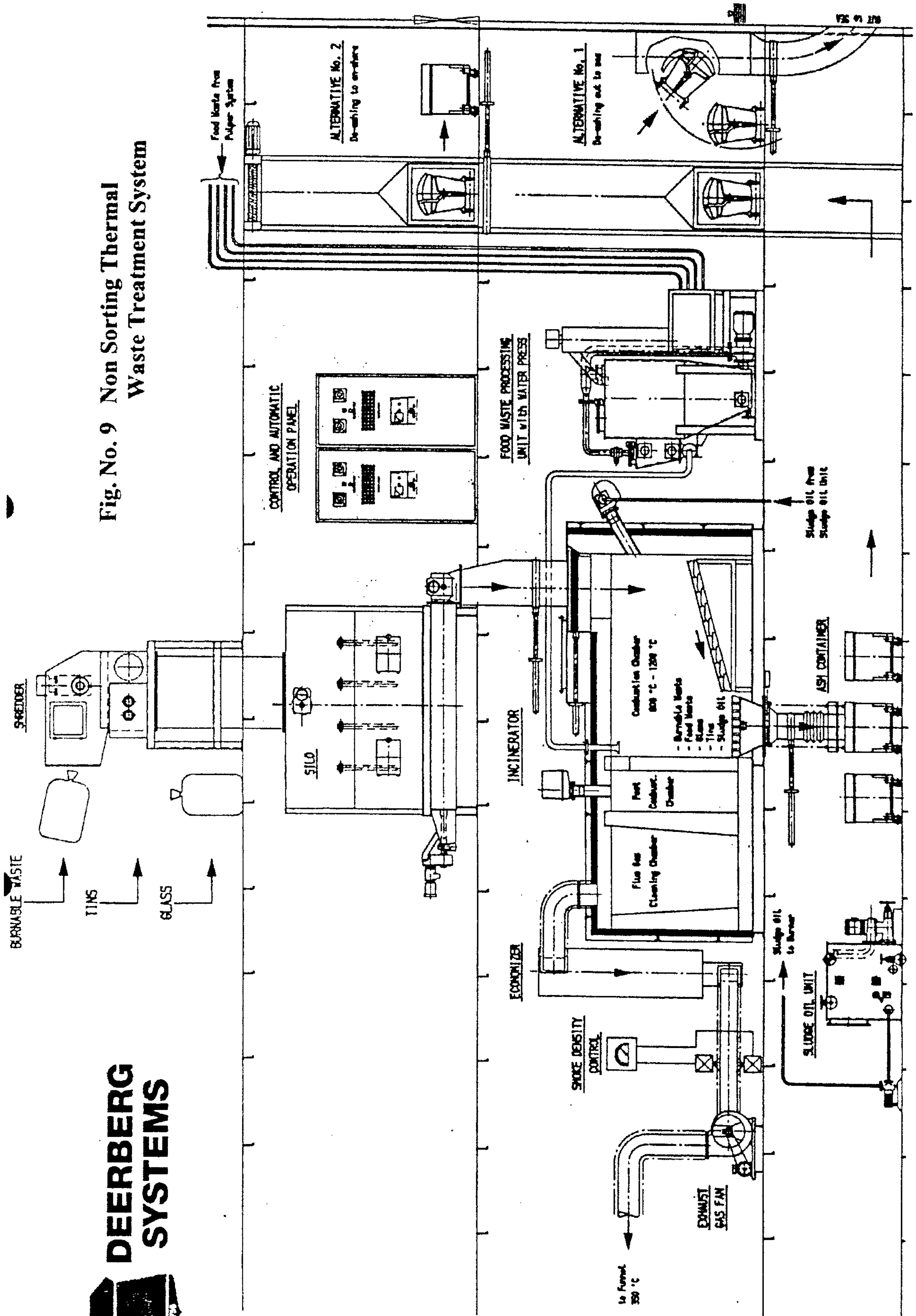
Fig. No. 9 Non Sorting Thermal Waste Treatment System



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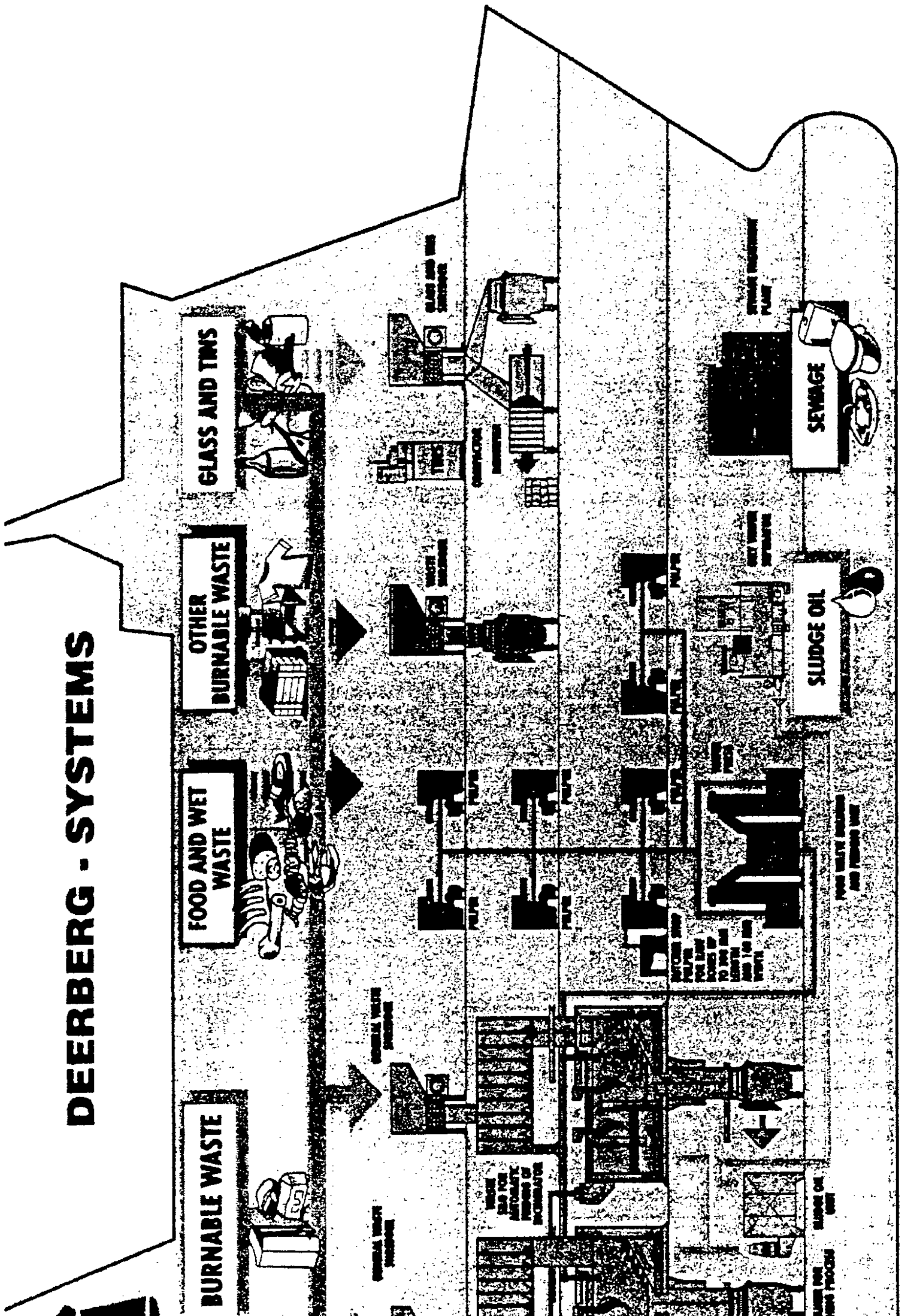

State-of-the-Art Multi Purpose Waste Management System

The optimal solution for economical operation and environmental protection

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3.1 Requirements for an INCINERATOR

- All different types of waste through the incinerator
- Special type of grate (MOVING GRATE)
- 3-Chamber Type

– 1st Chamber	Combustion Chamber
– 2nd Chamber	Post-Combustion Chamber
– 3rd Chamber	Cyclone Chamber

- Combustion Temperature between 850 ^{0}C and 1200 ^{0}C
- Minimum portions of unburned particles in the ash
- Low CO and NO_x concentration in the flue gas
- Clear flue gases, Flue Gas Density Nr. 1 (Bacharach) clear
- Safe operation

  – Double Feed Gate
  – High quality of Brick System
  – Cold surface
  – High quality of materials and workmanship
  – High avialability
  – Automatic and dust-free de-ashing into ash-container

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3.2 Combustion of waste combinations

Dependent of the total different amounts of calorific values (see fig. no. 1) **the incinerator is designed for the combustion of following waste combinations** (see fig. no. 10).

Type of waste with high calorific value	Combustion Combinations			
	Glass Tins	Food Waste	Medical Waste	Residuals Grey Water
Burnable Waste				
Sludge Oil				

Fig. No. 10 Combustion of waste combinations

Remark: A simultaneously combustion of Burnable Waste and Sludge Oil ist not efficient because of high calorific values of both fuels.

3.3 Components of a Thermal Waste Treatment System

For save and proper operation all necessary components of the thermal waste treatment system are special designed, able to handle the big amount of all different types of waste daily and to reduce the waste to a minimum of ash and solids (see fig. no. 11).

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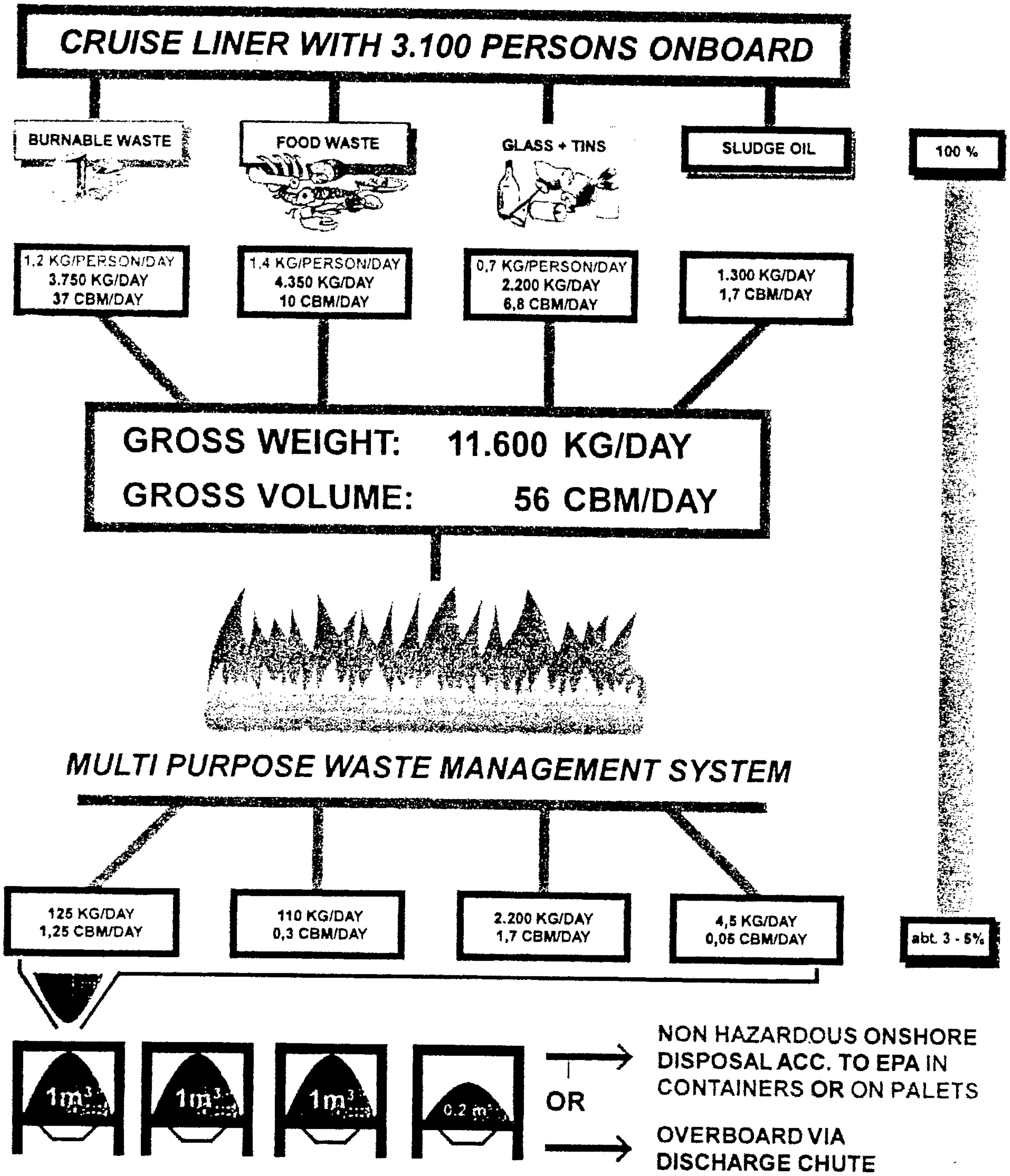

Fig. No. 11 Reduction of waste after combustion process

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3.3.1 SHREDDER

<u>Function</u>

Reduction of burnable waste and non burnable waste to small pieces with the purpose of volume reduction (see fig. no. 12 and 13).

Fig. No. 12 Unshredded Waste

Fig. No. 13 Shredded Waste

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Design Criterias

- **Robust design, unsensitive against short overload**
- **Sufficient driving power**
- **Solid cutting knifes** (see fig. no. 14 and no. 15)
- **Motor protection against high overload**
- **Reversing torque control**

Fig. No. 14 Solid cutting knifes of a shredder for handling burnable and non burnable waste

Fig. No. 15 Shredder with sufficient driving power able to handle all types of waste

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[illegible]

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3.3.2 Silo for storage of Unsorted Waste (see fig. no. 16)

Function

- **Storage of shredded waste until start of combustion**
- **Automatically controlled feeding of shredded waste into the double feed gate of incinerator**

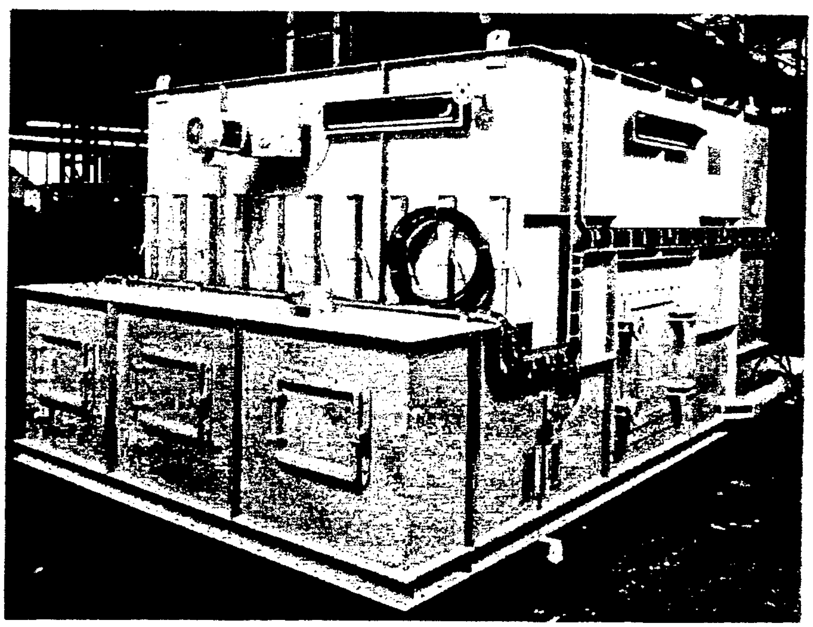

Fig. No. 16 Silo for dry waste

19

Design Criterias

- **Handling of shredded plastic and glass without any problems**
  (see fig. no. 17)

- **Silo body in such a design to prevent „bridge building“ of shredded waste**

- **Push bottom floor for transport of shredded waste to the integrated discharge screw conveyor**

- **Discharge screw conveyor in such a design to prevent blocking by long plastic strips**

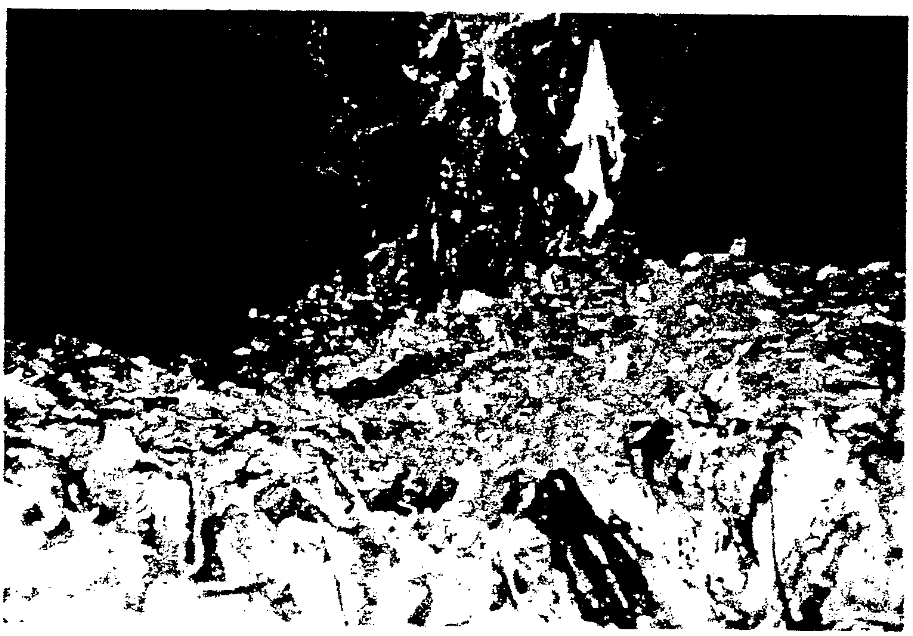

Fig. No. 17 Storage of shredded waste inside the silo with high amount of plastic

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3.3.3 INCINERATOR (see fig. no. 18)

To realize a minimum of emissions the following design criteria are of importance:

- **Design of the GRATE-SYSTEM**
- **Design of the COMBUSTION-CHAMBERS**
- **Design of the COMBUSTION-FRESH-AIR-DISTRIBUTION-SYSTEM**

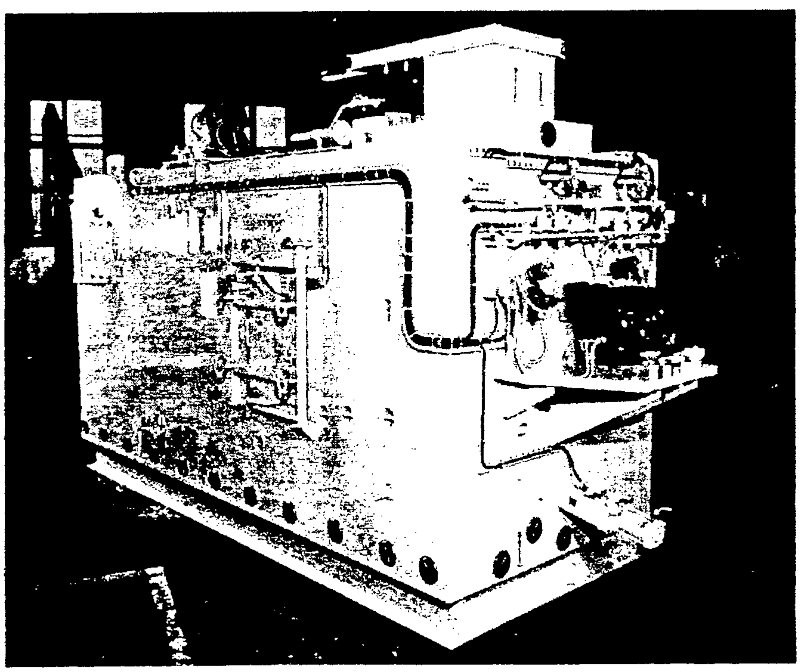

Fig. No. 18 INCINERATOR

3.3.3.1 Design Criteria for Incinerators to minimize the emissions

- **Grate System**

The Deerberg-Incinerator is equipped with Movable Grate Technology. This means the waste can be feed into the Incinerator NON SORTED (incl. Glass and Tins). During the transport through the incinerator the Movable Grate ensures circulation of the waste for a perfect burning out result and 100 % disinfected ash, incl. Glass and Tins (see fig. no. 19).

Combustion process on top of a movable grate

Drying

↓

Gasification

↓

Combustion

↓

Burning out

Fig. No. 19 Movable Grate with 100 % burned out ash and disinfected glass and tins

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Advantages of Moving Grate Technology

- **Combustion of unsorted waste**
- **Combustion of only Plastic without unburned residuals in the ash**
- **Handling of only Glass and Tins, for heating up and 100 % disinfection** (see fig. no. 21)
- **Low Emission fulfilling IMO 2000 already today**

Fig. No. 20 Heated up and disinfected glass after passing the Incinerator

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Combustion Chambers

3-Chamber type INCINERATOR (see fig. no. 21)

- **1[st] Chamber** **Combustion Chamber**
- **2[nd] Chamber** **Post-Combustion Chamber**
- **3[rd] Chamber** **Cyclone Chamber**

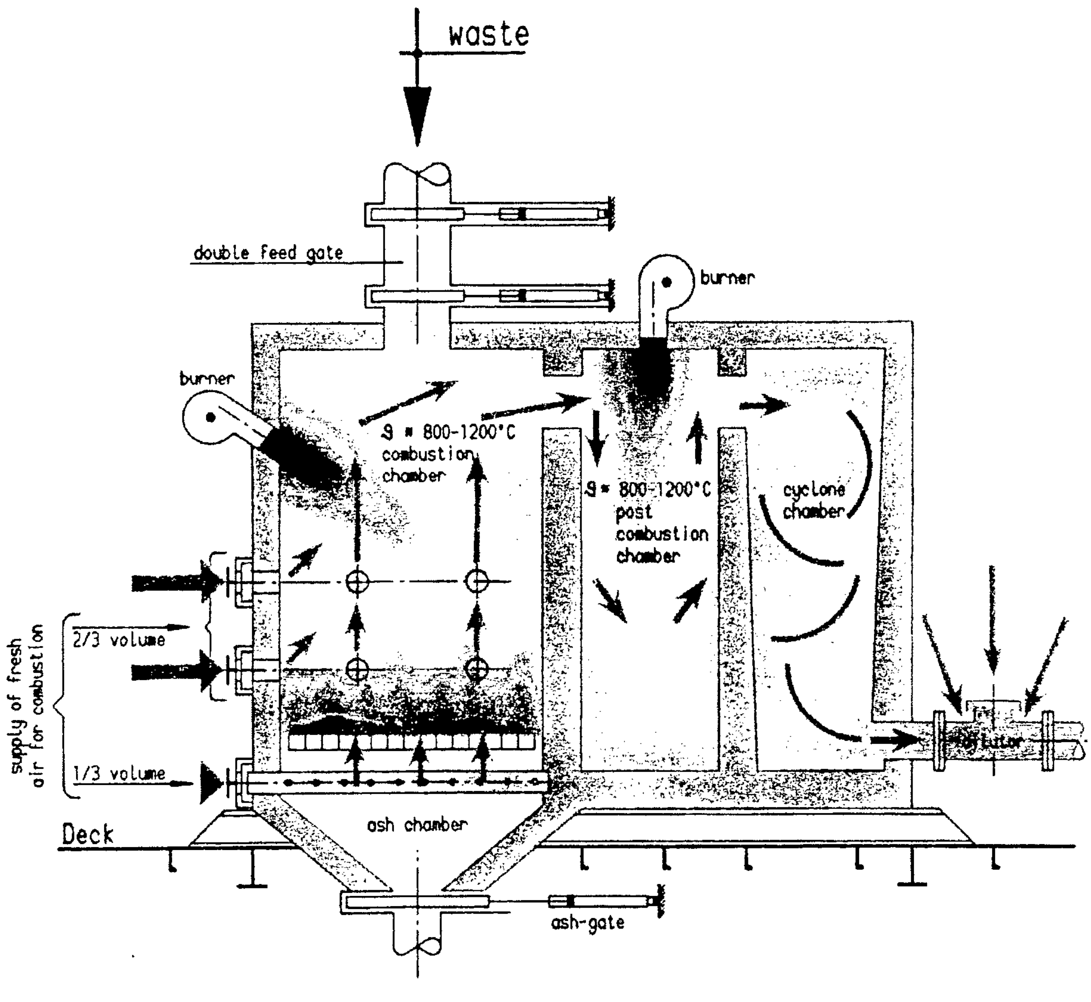

Fig. No. 21 3-Chamber Type INCINERATOR

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- **Combustion-Fresh-Air-Supply** (see fig. no. 22)

To guarantee a perfect combustion process, the supply of fresh air to the combustion process must be:

1/3 from underneath the Movable Grate

and

2/3 from above the Movable Grate

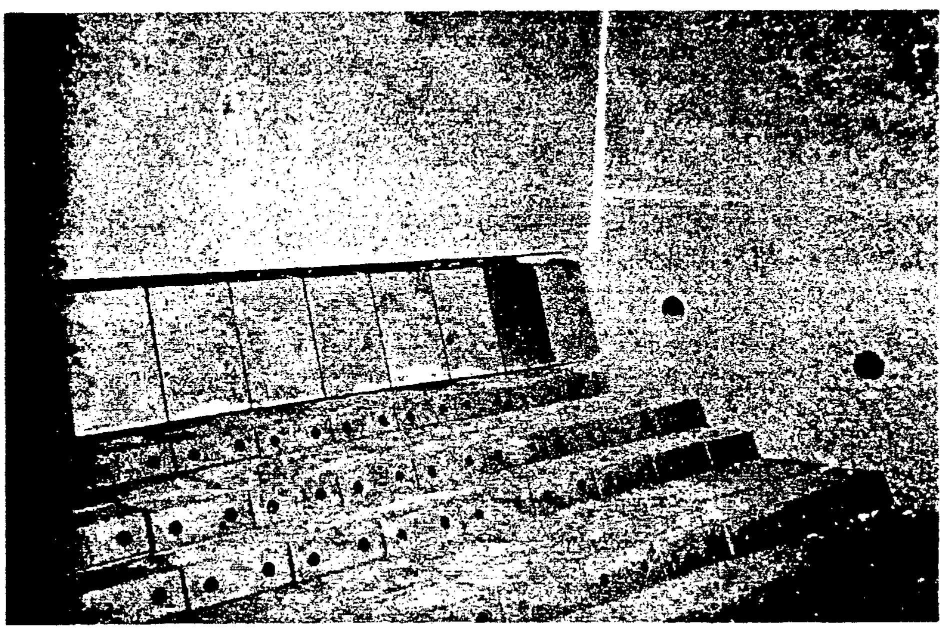

Fig. No. 22 Fresh Air supply inside the 1st combustion chamber

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3.3.4 Food Waste Incineration System

To fulfill all Rules and Regulations the Deerberg Food Waste Incineration System is based on the following philosophy:

- **Incineration of food waste with a special nozzle to fulfill the MARPOL-regulations** (see fig. no 23).

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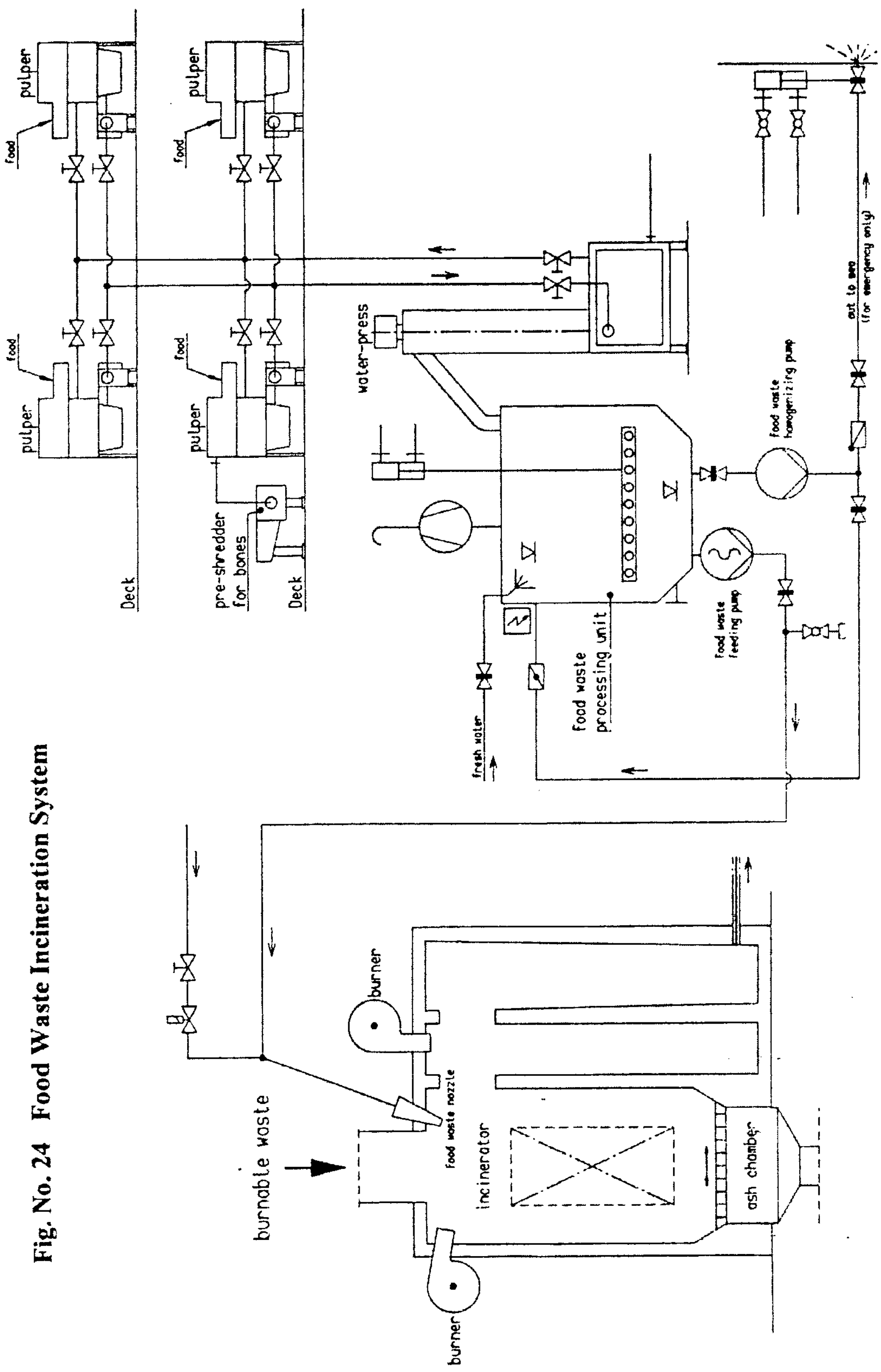

Fig. No. 24 Food Waste Incineration System

3.3.5 Sludge Oil Incineration System

A big problem on board is the daily amount of accumulated sludge oil on board, because:

- **The discharge over board is strictly prohibited**
- **The discharge to on-shore is very expensive**

Example: Daily amount of sludge oil accumulated on a cruise liner with 3000 peoples on board.
Abt. 2cbm/day

To solve the a. m. problems, the Deerberg Incinerators are equipped with special SLUDGE OIL BURNERS each with a combustion capacity of about 90 ltrs./hour (see fig. no. 25).

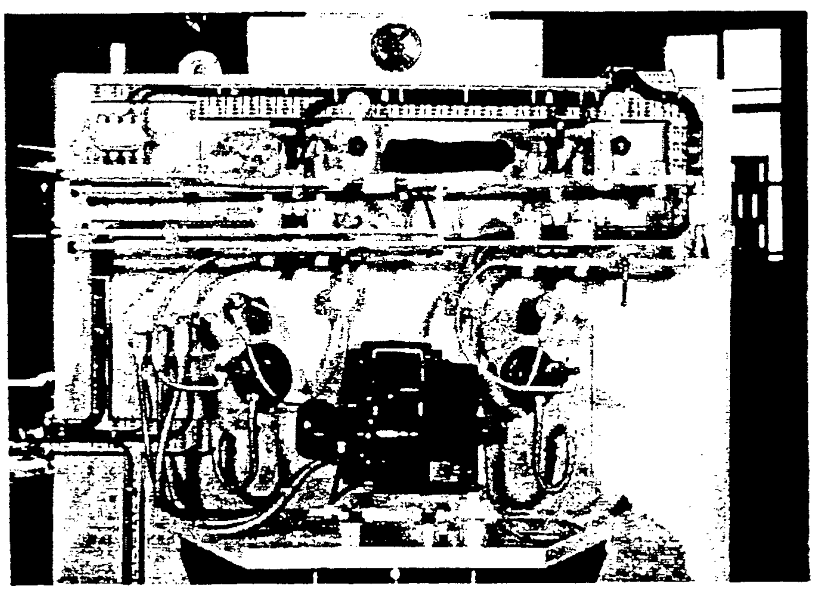

Fig. No. 25 Incinerator with 2 integrated SLUDGE OIL BURNER

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4. THERMAL WASTE TREATMENT -TOMORROW-

The passenger vessels are designed for an operation period of 20years and more.

CONSEQUENCE

The installed thermal waste treatment system has to fulfill the future regulations.

- **The future regulations for environmental protection will become stricter than today concerning:**

  - Discharge of waste to on-shore
  - Discharge of waste over-board
  - Flue Gas Emissions

- **Based on the experiances of Deerberg Systems a qualified combustion of all the different types of waste is only possible in an insinerator equipped with a MOVABLE GRATE.**

- **To meet the future rules and regulations a FLUE GAS CLEANING SYSTEM is necessary.**

  This flue gas cleaning system should be in a position to fulfill the German regulation 17th BimSchV, because this is one of the strictest regulation world wide.

  In connection with an Incinerator equipped with a movable grate technology such a flue gas cleaning system is described in fig. nos. 26 and 27.

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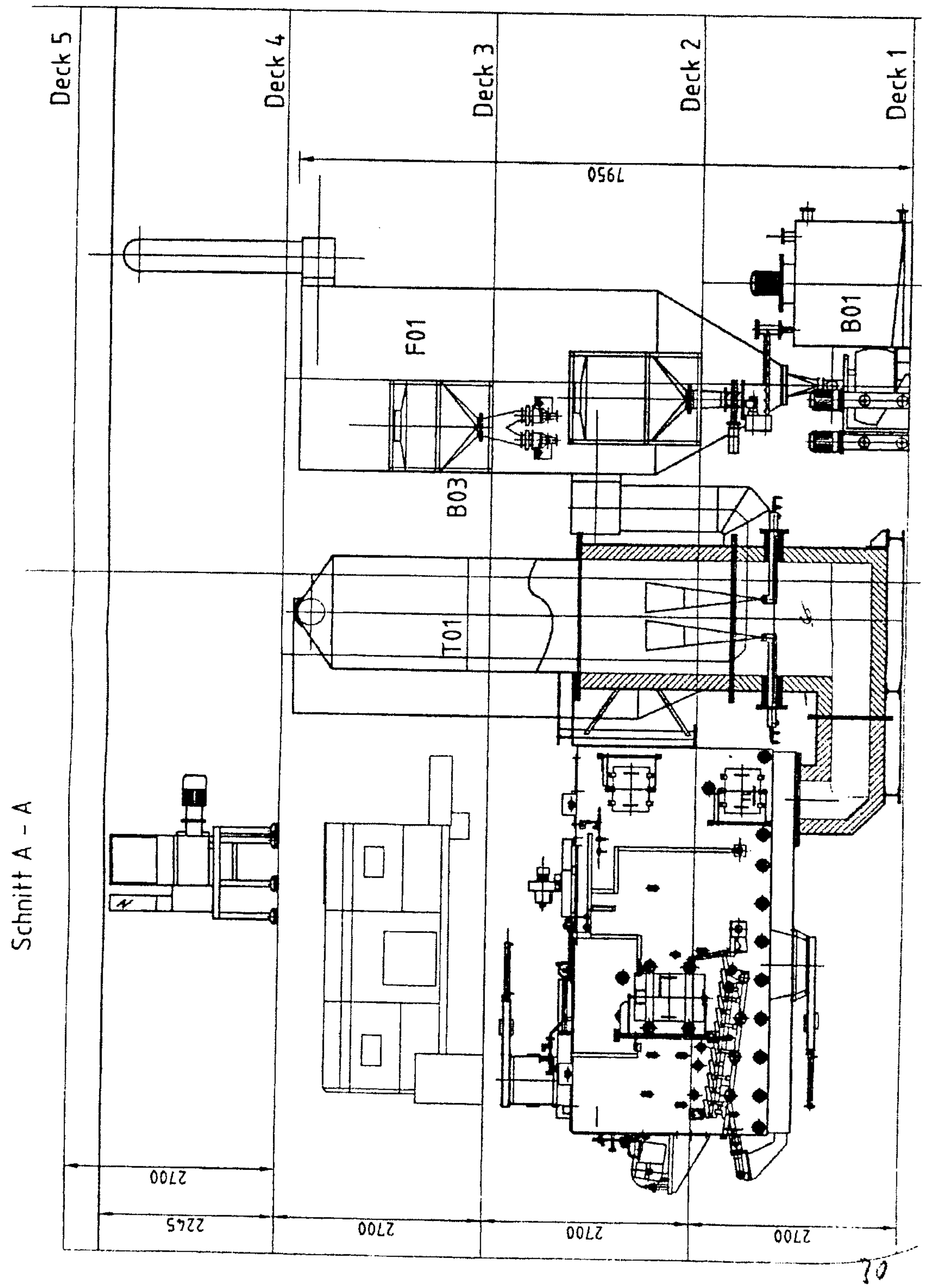
Fig. No. 26 Flue Gas Cleaning System in connection with an Incinerator with Movable Grate (Side View)



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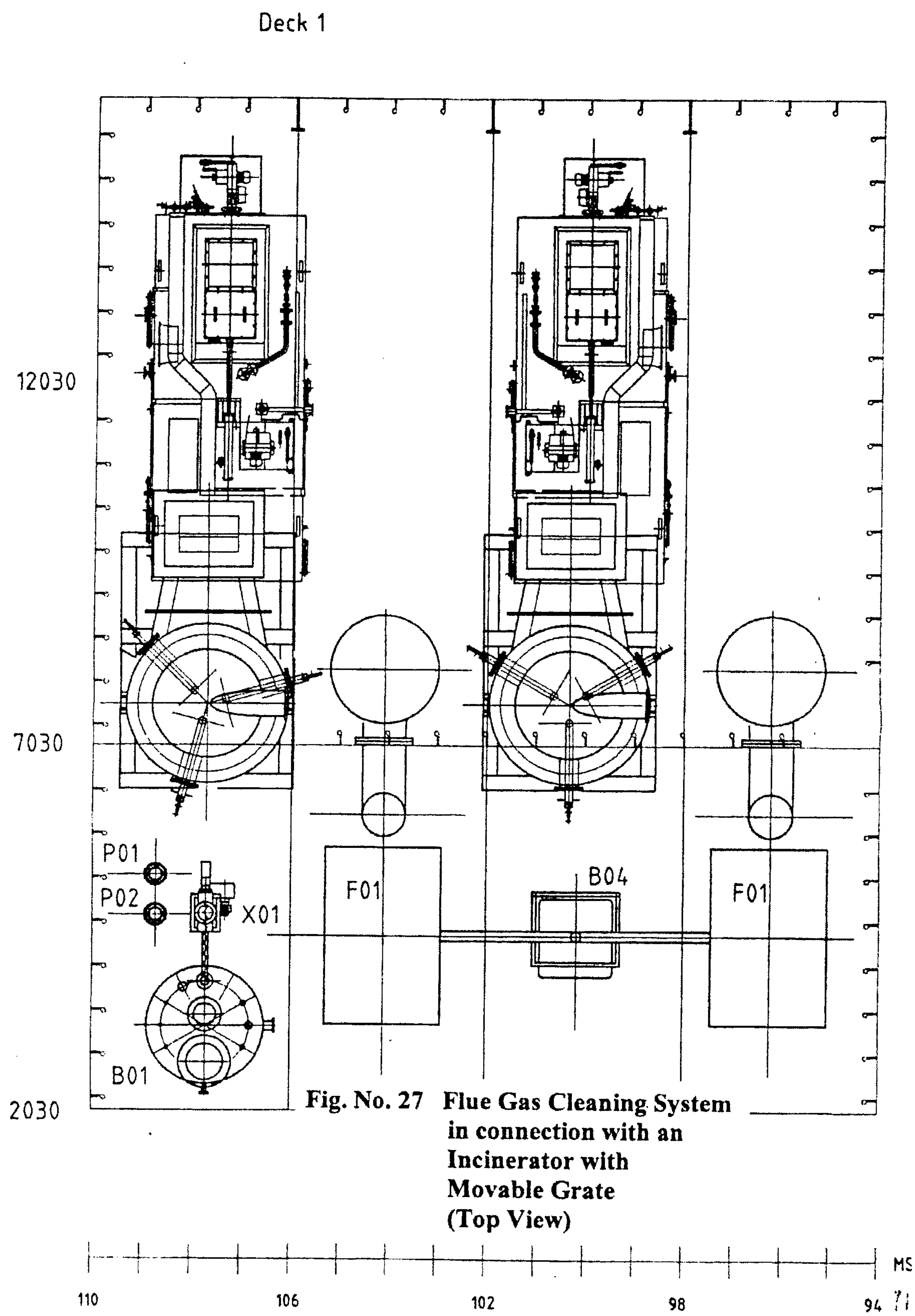

Fig. No. 27 Flue Gas Cleaning System in connection with an Incinerator with Movable Grate (Top View)

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TO1 Quench

- cooling down the flue gases
- absorbing the pollutant gases, HCL, HF and SO_2 by nozzle-injection of a calcium hydroxide suspension

KO1 Reactor

- final reaction of the pollutants with the calcium hydroxide

FO1 Filter

- to remove flying dust and residual materials from the flue gas stream

BO1 Linemilk preparation

- storage and supply of calcium hydroxide suspension to the Quench

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S2P2-ABSTR.DOC

DEVELOPMENT OF A PLASMA ARC SYSTEM FOR THE DESTRUCTION OF U.S. DEPARTMENT OF DEFENSE HAZARDOUS WASTE

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Presented by Dr. Richard C. Eschenbach, RETECH Services Inc. US

ABSTRACT

The Naval Base, Norfolk, located in the northern portion of the city of Norfolk, Virginia, is the world's largest naval base and home of the Atlantic Fleet. Activities at the naval base generate approximately 1.4 million kilograms (3.0 million pounds) of industrial waste (hazardous and non-hazardous) annually. Significant components of the waste stream include used paint, cleaning rags, cleaning compounds, solvents, and other chemicals used in industrial operations. The costs of disposing of this waste are significant and are currently over $4 million annually, representing an average of $3.30 per kilogram ($1.50 per pound).

Plasma arc technology has been identified as having the potential to cost-effectively treat and destroy various types of waste materials, including contaminated soil, ordnance, pyrotechnics, and low-level radioactive waste. There are currently several pilot-scale plasma arc units being tested in the United States, but at present there are no fully-permitted production-scale units in operation.

In July 1995 a project was awarded to the Naval Research Laboratory and Norfolk Naval Base under the DOD Environmental Security Technology Certification Program with the objective of establishing a production scale demonstration plasma arc hazardous waste treatment facility (PAHWTF) at the Naval Base that would be capable of destroying both solid and liquid waste on a production basis and obtaining operational data necessary to determine the cost effectiveness of the process. This paper provides a detailed description of the PAHWTF, which is currently under construction, and also provides results of a treatability study conducted on waste paint using an existing plasma arc unit. Information is also provided on the progress of completing an Environmental Impact Statement and obtaining RCRA Research, Development, and Demonstration, and air permits.

DEVELOPMENT OF A PLASMA ARC SYSTEM FOR THE DESTRUCTION OF U.S. DEPARTMENT OF DEFENSE HAZARDOUS WASTE

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The Naval Base, Norfolk, located in the northern portion of the city of Norfolk, Virginia, is the world's largest naval base and home of the Atlantic Fleet. Activities at the naval base generate approximately 1.4 million kilograms (3.0 million pounds) of industrial waste (hazardous and non-hazardous) annually. Significant components of the waste stream include used paint, cleaning rags, cleaning compounds, solvents, and other chemicals used in industrial operations. The costs of disposing of this waste are significant and are currently over $4 million annually, representing an average of $3.30 per kilogram ($1.50 per pound).

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INTRODUCTION

Naval bases located around the United States generate large quantities of both solid and liquid hazardous waste, both from shore activities and from material offloaded from ships in port. These facilities must expend a significant amount of funds for the disposal of these various materials, which usually involves the issuance of contracts to private firms to pick up and dispose of the waste in incinerators or hazardous waste landfills. Not only is this extremely costly to the bases, but there is also the issue of long-term liability associated with the off-site disposal.

The intent of the project described in this paper is to establish a full-scale plasma arc hazardous waste treatment facility (PAHWTF) at the Norfolk Naval Base. The development of the PAHWTF is a joint project between the Naval Base and the Naval Research Laboratory. It is being funded primarily by the Environmental Security Technology Certification Program (ESTCP), a special Congressionally-authorized program under the auspices of the Deputy Under Secretary of Defense for Environmental Security.

The ESTCP program responds to the following direction:
- Congressional concern over the slow pace of site remediation and clean-up at DOD facilities
- Congressional direction to conduct demonstrations specifically focused on emerging new technologies
- Executive Order 12856, Federal Compliance with Right-to-Know Laws and Pollution Prevention Requirements, which mandates that federal agencies place high priority on obtaining funding for developing innovative pollution prevention programs for installations; and
- The need to improve defense readiness by reducing environmental costs.

Once a lab-proven technology with broad DOD market application is selected, the strategy is to aggressively move it to the field for rigorous trials documenting its cost, performance, and market potential. Successful demonstration would lead to acceptance of innovative technologies by DOD end users and the regulatory community. The program also emphasizes the importance of public involvement and ensuring public health and safety.

Once established at the Norfolk Naval Base, the PAHWTF would initially be operated under the ESTCP Program as a demonstration facility to: (1) Demonstrate the complete destruction of solid and liquid hazardous wastes on a production basis; and (2) Obtain the operational data needed to document the performance and cost effectiveness of plasma arc technology. Following this initial demonstration period, the PAHWTF would be operated on a full-production basis to treat a major portion of the waste generated at the Naval Base. The benefits of using the PAHWTF to destroy the waste on-site are:
- Economy of operation - it is anticipated that the PAHWTF would be more economical to operate than disposing of the hazardous waste through conventional channels
- The residue to be disposed would consist of a glasslike, nonleachable substance called slag, safe to handle, transport, and dispose
- Handling and transport of hazardous waste at the Naval Base would be minimized, thereby reducing potential worker and community exposure
- Long-term federal liability for disposal of hazardous waste off-site would be minimized.

In order to successfully establish the PAHWTF at the Naval Base, it is necessary to complete an Environmental Impact Statement and to obtain a RCRA Research, Development and Demonstration (RD&D) Permit and an air permit under the Clean Air Act. In May 1996 the Naval Research Laboratory issued a Request for Proposals (RFP) for design, construction, and installation of a plasma arc system. The Statement of Work for the RFP consisted of a combination of component and performance specifications. In September 1996 NRL awarded a contract to Retech, a Division of Lockheed Martin Advanced Environmental Systems for development of the plasma arc system. Also in September 1996 Retech conducted a treatability study on waste paint from the Norfolk Naval Base in order to determine emissions and the leachability of the slag. In the following sections, each of these areas will be described in detail.

PAHWTF DESIGN AND TESTING

As mentioned above, the requirements developed by NRL for the PAHWTF were a combination of component and performance specifications. The following components have to be provided by the contractor: (1) Feeder systems, (2) primary processing chamber containing a plasma torch, (3) slag collection chamber and extraction mechanism, (4) secondary combustion chamber containing a plasma torch, (5) offgas treatment system, and (6) control and data acquisition system. The types of waste that were specified to be processed by the PAHWTF are listed in Table 1. The PAHWTF had to be capable of continuous 24-hour-per-day

operations, with the average percentage of down time (defined as the time when waste material is not being introduced into the system and destroyed) for procedures such as slag extraction and the performance of preventive and corrective maintenance not exceeding 40%. The average processing rate for the wastes listed in Table 1 was specified to be not less than 600 pounds (272 kg) per hour for inorganic materials and not less than 450 pounds (205 kg) for organic materials, with the processing rate for mixtures of inorganic and organic materials interpolated between those two values. These throughputs were selected based on a desire for the PAHWTF to be capable of processing more than 50% of the total waste generated at the base if operated continuously with an uptime of 60%.

Table 1. Types of waste to be processed in the PAHWTF

Paint (including latex, lead-base, and metal-oxide containing)
Solvents, both halogenated and non-halogenated
Cloth rags contaminated with oil, hydraulic fluid, and solvents
Dirt contaminated with oil and hydraulic fluids
Oil and lubricating oil
Tubes of grease
Reactive chemicals
Plastic media blast material contaminated with paint
Batteries containing acids and heavy metals
Adhesives
Petroleum distillates
Sludge from high-pressure-water paint removal operations
Glass

There were several requirements for the feeding of this waste into the PAHWTF. Since many of the waste liquids are contained in 55-gallon (208 liter) drums, the PAHWTF had to be capable of tapping and pumping the liquids from the drums directly into the primary processing chamber, with a provision that operators would not be exposed to the contents or vapors emanating from the contents of the drums. A large percentage of the waste is in metal containers of size 5 gallons (19 liters) and smaller. For these, the feeder was required to consist of a mechanism that would cut open the containers, allowing any liquid to flow into the liquid feeder, with the containers and remaining solid contents being introduced in a batch mode directly into the primary processing chamber. For this reason, two feeder systems are included in the design. A liquid feeder is designed to pump liquid waste from a 55 gallon drum into the primary chamber on the floor level of the complex. In addition, a small can solid feeder is designed to compact up to a 5 gallon can of mostly solid waste. This feeder will collect residual liquid from the compacted cans for feeding into the primary chamber.

The emissions from the PAHWTF during treatment of any of the materials listed in Table 1 were required to consist primarily of releasable gas and a vitrified solid slag. The PAHWTF had to comply with 40 CFR Part 61 (National Emission Standards for Hazardous Air Pollutants), 40 CFR Part 50 (National Primary and Secondary Ambient Air Quality Standards), 40 CFR Part 60 (Standards of Performance for New Stationary Sources) and 40 CFR Part 264 (EPA Regulations for Owners and Operators of Permitted Hazardous Waste Facilities - Subpart O). In addition, since the PAHWTF is being located in Virginia, it had to comply with the Virginia Department of Waste Management Regulation VR 672-10-1 (Hazardous Waste Management Regulations) and Virginia Regulations for the control and Abatement of Air Pollution VR 120-01. Any slag generated by the PAHWTF had to be capable of passing the EPA toxicity characteristic leaching procedure (TCLP) test for all TCLP materials.

According to EPA standards 40 CFR Part 61 and the 1990 Clean Air Act Amendments, the pollutants emitted by the PAHWTF into the atmosphere will be limited to levels reflecting the application of the

Maximum Achievable Control Technology designated as the MACT standards. These are summarized in Table 2.

Table 2. MACT Standards to be Achieved by PAHWTF

Dioxins and Furans	0.20 nanograms/dscm
Particulate Matter	0.030 gr/dscf
Mercury	50 micrograms/dscm
Semi-Volatile Metals (Cd and Pb)	62 micrograms/dscm
Low-Volatile Metals (Sb, As, Be, Cr)	60 micrograms/dscm
Hydrogen Chloride and Chlorine	67 ppmv
Carbon Monoxide	100 ppmv
Hydrocarbons (expressed as propane)	12 ppmv

Notes:

dscm = dry standard cubic meters
dscf = dry standard cubic feet
ppmv = parts per million by volume

Following a competitive solicitation, a cost-type contract was awarded to the Retech Division of M4 Environmental Management for the design, construction, installation, and testing of the PAHWTF, with a total value of $5.45 million. Figure 1 is a schematic of the PAHWTF that is currently being constructed by Retech.

The primary processing chamber (PPC) is designated as a PACT-8 unit (Plasma Arc Centrifugal Treatment) containing an 8-foot diameter (2.4-meter-diameter) centrifuge. The plasma torch to be installed in the PPC will operate in the transferred mode and will be capable of 1.0 megawatt operation, although only a 750-kilowatt power supply will be provided since that is all that is required to meet the throughput specifications. Both solids and liquids can be fed directly into the chamber either separately or simultaneously. Organic material is volatilized by the extremely high heat in the chamber, with oxygen being introduced to provide for partial oxidation to CO. The PPC houses a rotating hearth to collect inorganic materials and retain them for treatment by the plasma torch. The material is heated by the torch to approximately 1600°C and forms a molten slag. The rotational speed keeps the molten slag contained in the centrifuge to ensure complete processing. When sufficient slag has been processed in the PPC, the centrifuge is slowed and the molten material flows through an opening in the center down into a mold contained in the slag collection chamber. The plasma torch pylon assembly provides an indexing mechanism for transferring the torch assembly from an operating position to a maintenance position which permits the electrode to be changed in less than 2 hours. The slag collection chamber contains a safety mold to collect any material that inadvertently flows through the centrifuge opening and a collection mold that can be extracted from the chamber on a trolley.

The secondary combustion chamber (SCC) ensures complete oxidation of any products of incomplete combustion that exit from the PPC. The SCC is sized to handle the maximum gas load that can result from processing the highest organic feed at the feed rate of 450 pounds (205 kg) per hour. The heat source for the SCC is a 750 kW non-transferred plasma torch which allows the SCC internal ambient temperature to be maintained above 980°C (1800°F) at the required off-gas rates. The inside volume of approximately 10 cubic meters (370 cubic feet) assures a minimum 2 second residence time when running at the maximum flow rate. Sufficient oxygen will be introduced into the SCC through a separate port to ensure complete combustion of all of the gases before exiting to the off-gas treatment system.

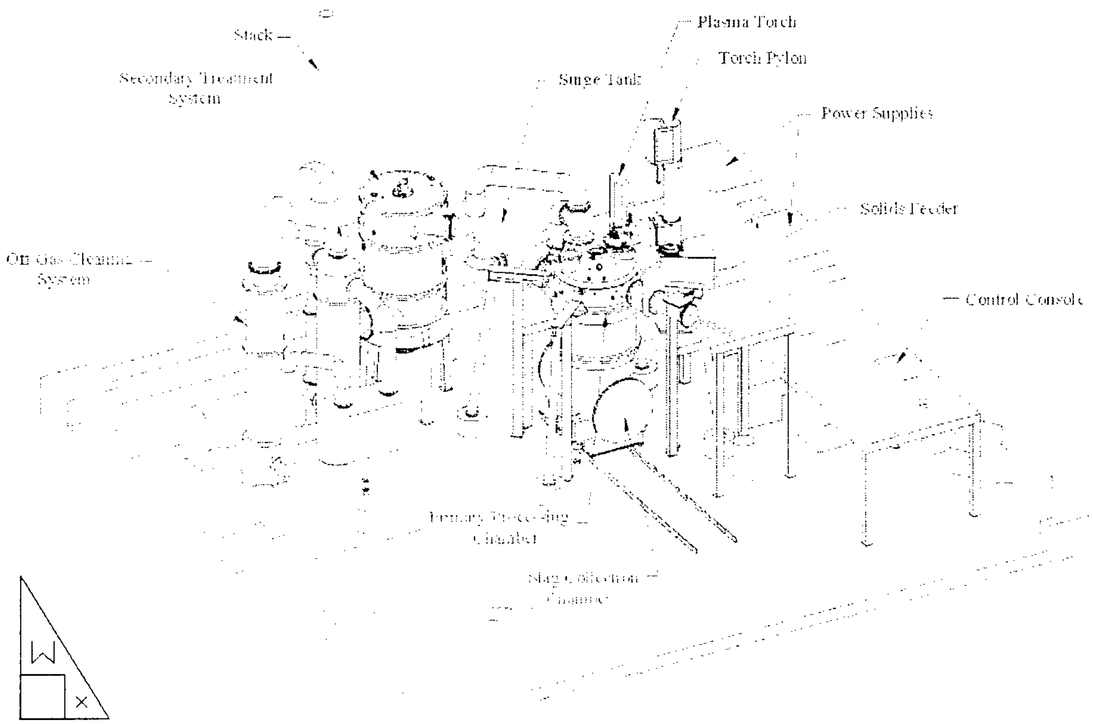

Fig. 1

The off-gas treatment system will be provided by Merlin Company of Boulder, Colorado. The gases exiting the SCC will first pass through an evaporative cooler which will lower the gas temperature from 2200°F (1200°C) to 250°F (137°C). For treatment of some of the waste materials from the Norfolk Naval Base, the off-gas from the SCC will contain the ingredients sufficient for generation of post-reaction dioxins and furans. The four ingredients that must be present are HCl/Cl_2, fine particulate (dioxin formation is a surface reaction), iron or copper oxides (serve as catalysts), and dwell time in the temperature range of 400-750°F (204-400°C). By using water injection for cooling, the off-gas is quenched in less than a second to a temperature well below the dioxin formation range. The low outlet temperature will also provide maximum condensation of volatile metal species such as lead and mercury. The lead will remain entrained as small particulate in the off-gas and will be collected in the filters (see below). Most of the mercury will separate and collect in the base of the cooler.

The cooled off-gas then passes through a drier which adds heated air to the gas stream to help prevent moisture from forming and then into a filtration system consisting of high-surface-area fiber cartridges which are cleaned periodically using a pulse of high-pressure air. The material removed from the filters is recycled back into the PPC. The gases exiting the filtration system are introduced into a conventional scrubber which captures any acid gases entrained in the off-gas and converts the acids to salt. The salt concentration is allowed to reach 6 wt% before blowdown is required. The off-gas then passes through a heat recuperator, an induced-draft blower, and then out the stack. The recuperator reheats the gas slightly to

remove the moisture before the gas enters the blower. Downstream of the blower but prior to the stack there will be several ports for continuous emissions monitoring equipment.

The PAHWTF will initially be placed into operation at Retech's facility, with a factory inspection test (FIT) to be performed that consists of treatment of 400 kg of the following types of waste: (1) paint, (2) chlorinated solvent, and (3) rags soaked with oil or hydraulic fluid. Because of the small quantities of material to be treated, the purpose of the FIT is not to demonstrate throughput, but to demonstrate destruction efficiencies and that the emissions from the system meet the specifications.

Following successful completion of the FIT and assuming that all necessary permits are obtained and the Environmental Impact Statement is completed (as described in subsequent sections), the PAHWTF will be disassembled, shipped to Norfolk, and constructed and placed into operation in an existing building at the naval base. Then the contractor, in conjunction with Navy personnel, will conduct a systems acceptance test (SAT). This will consist of treating the same materials as in the FIT, with the quantities of each waste to be treated increased to 1000 kg.

TREATABILITY STUDY ON WASTE PAINT

In September 1996, the Norfolk Naval Base shipped 181 kg (400 pounds) of waste paint to Retech for the purpose of having Retech conduct a treatability study using their existing PACT-2 system to determine the effectiveness of plasma arc to destroy the paint. The design of the PACT-2 system is very similar to the proposed design for the PAHWTF, including the utilization of a plasma torch in the SCC. The total amount of waste processed was 160 kg consisting of 135 kg liquid paint, 12 kg solid paint, and 12 kg soil. The paint was strained prior to introduction into the system and the solids were mixed at a 1:1 dilution with soil. The average feed rate was 17 kg/hour for the liquid and 15 kg/hour for the solid/soil mixture. Total material collected was 56 kg, of which 48 kg was poured as slag, 7 kg removed from the centrifuge, and 1.0 kg collected as wet scrubber particulate. Table 3 summarizes the emission test results during the treatment of the waste paint which indicate that all of the MACT standards were achieved.

Table 3. Summary of emissions from treatment of waste paint on PACT-2

Emittant	Value	Units
Nitrogen oxides	1800	ppm
Particulate matter	0.0023	grains/dry standard cubic feet
Volatile organic compounds	7.3	ppm
Carbon monoxide	93	ppm
Hydrogen chloride	0.25	ppm
Sulfur oxides	0.25	ppm
Semi-volatile metals (Cd, Pb)	10	micrograms/dscm
Low-volatile metals (Sb, As, Be, Cr)	2.9	micrograms/dscm

ENVIRONMENTAL IMPACT STATEMENT

The National Environmental Policy Act (NEPA) provides for consideration of environmental issues in federal agency planning and decision-making. Under NEPA, agencies of the federal government must prepare an environmental impact statement (EIS) for actions that may significantly affect the quality of the

human environment. The EIS must provide full disclosure of significant environmental impacts and inform decision-makers and the public of the reasonable alternatives that would avoid or minimize adverse impacts or enhance the quality of the human environment. Figure 2 illustrates all of the steps involved in the NEPA process in order to complete the EIS and obtain a Record of Decision.

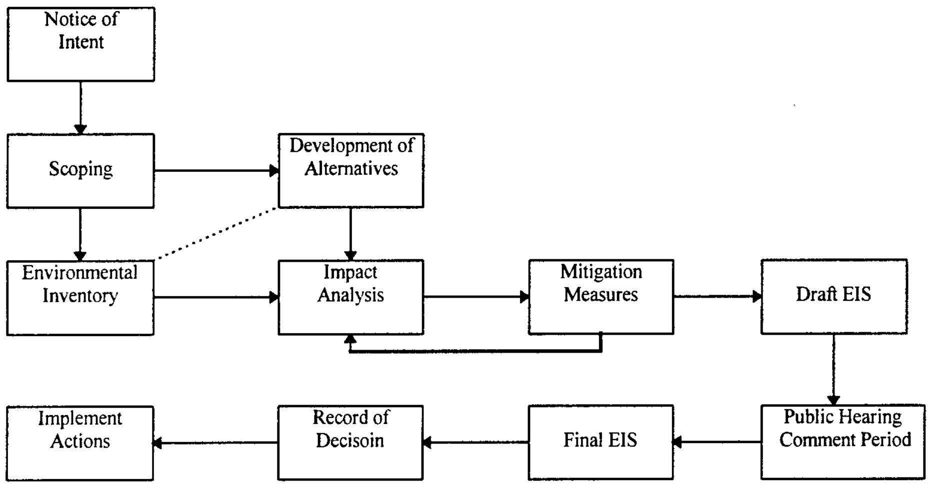

Fig. 2. Flowchart of the NEPA process necessary to complete an environmental impact statement.

The first step in the NEPA process is the publication of a formal Notice of Intent (NOI) to prepare the EIS. The NOI for the PAHWTF project was published in the *Federal Register* on March 19, 1996 and broadly described the proposed action, the alternatives to be considered, and the analyses to be conducted for the EIS. It also announced the time and place for a public scoping meeting and invited public comment. Scoping is conducted early in the EIS process to involve parties that may be affected by implementation of the proposed action, with a goal of defining significant issues for consideration. In addition to publishing the NOI, 60 scoping letters were sent to the Virginia senators, congressmen from the Hampton Roads area, state and local officials, EPA headquarters and Region III headquarters in Philadelphia, other federal agencies, and the Virginia Department of Environmental Quality. The public scoping meeting was held April 16, 1996 at a local elementary school and was attended by approximately 40 citizens. No significant opposition to the project was indicated at the meeting, but several areas of concern were identified including: (1) slag disposal requirements, (2) potential changes in the physical and chemical composition of the slag if placed in a landfill, (3) capability of the PAHWTF to destroy unknown or mislabelled hazardous waste, (4) storage of waste prior to introduction into the system and the potential for spills, and (5) adequacy of monitoring and safety systems.

A Draft Environmental Impact Statement (DEIS) has been completed and is currently under review by senior Navy officials. This document, consisting of more than 300 pages, is divided into the following major sections: (1) Purpose and Need, (2) Description of the Proposed Action and Alternatives, (3) Description of Affected Environment, (4) Impacts of the Proposed Action, (5) Mitigation Measures, (6) Relationship of the Proposed Action to Federal, State, and Local Plans and Policies, and (7) References. Under Section 2, there is a description of the sources and types of hazardous waste that would be introduced into the PAHWTF,

a description of plasma arc technology, and a discussion of the two alternative sites, with the preferred site being a 20-meter high building formerly used by the Norfolk Naval Aviation Depot and which is intended to be the central hazardous waste storage facility for the entire base. Under Section 3, there is a description of the current land use in the vicinity of the base, demographics, community facilities, local transportation, existing air quality, noise, infrastructure at the base, and cultural and natural resources. In Section 4, the impact of the installation and operation of the PAHWTF on all of the above areas is described. In Appendices to the DEIS, there are air contaminant emission rate estimates, air quality impact dispersion modeling, and an accidental release analysis.

Once the DEIS has been approved, a Notice of Availability is published in the *Federal Register*. The DEIS is then subject to public review during a 45-day public comment period, which will include a public hearing, tentatively scheduled for the Fall of 1997. Public comment is sought on a variety of issues including the range of alternatives considered and their associated impacts, the accuracy and completeness of data included, and the conclusions reached in the document. Following this, a Final EIS (FEIS) is prepared which incorporates, and formally responds to, public comment received on the DEIS. This response can take the form of corrections of data inaccuracies, clarifications of and modifications to analytical approaches, inclusion of additional data or analyses, and modification of the proposed action or alternatives. The preferred alternative for implementation is identified in the FEIS. Once completed, the FEIS is circulated for public review. Finally, a Record of Decision (ROD) is issued, no less than 30 days after the FEIS has been made available. The ROD establishes the proposed action, describes the public involvement and agency decision-making process, and presents the commitments to mitigation measures. The proposed action can then be implemented. For the PAHWTF, it is hoped that a ROD can be obtained by February 1998.

RESEARCH, DEVELOPMENT, AND DESMONSTRATION (RD&D) PERMIT

Because of the anticipated large amount of time required to obtain a Resource Conservation and Recovery Act (RCRA) Part B permit for operation of the PAHWTF as a full production facility, it was decided to initially pursue a RCRA RD&D permit and subsequently submit a permit application for full operation. The Hazardous and Solid Waste Amendments of 1984 amended Section 3005 of RCRA to give the EPA new permit authority to issue RD&D permits for innovative and experimental hazardous waste treatment technologies or processes. The purpose of RD&D permits is to aid the development of safe alternatives to land disposal of hazardous wastes by allowing applicants to conduct experimental testing or demonstration of new hazardous waste treatment technologies or processes by modifying or waiving most of the RCRA permit application and procedural requirements.

There are, however, a number of elements that must be included in an RD&D permit application, and which are currently being prepared for the PAHWTF application, following the instructions in the Guidance Manual for RD&D Permits Under 40 CFR Section 270.65 (EPA 530-SW-86-008) dated July 1986. The elements of the permit application are:

- Purpose of the research
- Explanation of the experimental and innovative nature of the research
- Description of the facility and proposed activity
- Type and quantity of hazardous wastes with waste analysis plan
- Estimated timeframe to conduct the research activities
- Anticipated performance of the system
- Sampling and monitoring plan including QA/QC
- Names and qualifications of research personnel
- Safety plan
- Closure plan

Further guidance provided by EPA Region III Office indicated that the PAHWTF must meet the substantive requirements of 40 CFR Part 266, Subpart H (relating to boilers and industrial furnaces). Therefore, the permit application must also include:

- Estimated emission rates and control measures for metals, halogens, and particulate matter
- Estimated destruction and removal efficiency for incoming hazardous organic compounds

- Estimated emission rates and control measures for products of incomplete combustion, specifically including dioxins and furans
- A detailed description of the air pollution control train
- Monitoring provisions and proposed parameter control limits that will be employed throughout the RD&D period to ensure ongoing attainment of the projected emission rates

Regarding the amount of material that can be treated during the RD&F period, current guidance indicates that only 15,000 kg of hazardous waste can be treated per month, with a maximum of 400 kg treated per hour in any experiment or run. The EPA does have the authority to modify these limits if deemed appropriate. Since the PAHWTF will be capable of treating approximately 250 kg per hour, and since the most efficient operation of the unit will be 24 hours per day for multiple days, then it is anticipated that the unit will be operated in that mode for five days each month with a 60% uptime (i.e., waste being fed into the unit).

The anticipated dates associated with obtaining the RD&D permit are as follows:

- September 1997: Draft permit application reviewed by Navy officials
- October 1997: Navy submits permit application of EPA
- October 1997: Public hearings associated with permit application
- January 1998: EPA completes review and comment period
- February 1998: Permit effective

If these dates are achieved, then site preparation work would be conducted early in 1998, with installation of the system in approximately August 1998. The RD&D permit would be effective for one year from the date operations commence, and could be renewed for two additional years.

AIR PERMIT

A permit for operation of the PAHWTF under the Clean Air Act will also have to be obtained. As discussed above, the unit will be expected to meet the MACT standards delineated in Table 2. Based on the treatability study conducted at Retech on waste paint in the PACT-2 unit, it is expected that the PAHWTF will be able to achieve these standards.

Calculations have been made of the estimated emissions from the PAHWTF during treatment of any of the materials listed in Table 1. These are indicated in Table 4.

Table 4. Estimated air contaminant emission rates for the PAHWTF

	Estimated emission rates, kg/hr	
Contaminant	Maximum	Average
Nitrogen oxides	4.20	3.30
Particulate matter	0.40	0.31
Chlorine and hydrogen chloride	1.70	0.20
Sulfur dioxides	0.40	0.30
Carbon monoxide	0.26	0.20
Volatile organic compounds	0.05	0.04
Dioxin/furan toxic equivalents	4.4E-10	3.4E-10
Toxic organic chemicals	0.02	0.02
Mercury	1.1E-4	1.0E-4
Semi-volatile metals	1.4E-4	1.1E-4
Low-volatile metals	1.3E-4	1.0E-4

It is possible that there could be a problem with the NO_x emissions. Although the specifications for the PAHWTF indicate a maximum emission level of 1000 ppm, the tests conducted on the waste paint at Retech indicated an average of 1800 ppm. If this level were to exist for the PAHWTF and if it were to be operated as a full production facility, then the total amount of NO_x emitted would be approximately 50,000 kg (55 tons) per year. The threshold value for both New Source Review and Prevention of Significant Deterioration under the Clean Air Act is 40 tons per year. If the unit were to exceed this limit, then additional permitting work would be required. Therefore, it will be critical that the unit emit less than the 1000 ppm of NO_x as specified. To meet this specification with the least expensive emission control system, the PPC will be operated in a reduced (i.e., sub-stoiciometric) atmosphere.

SUMMARY AND CONCLUSIONS

A plasma arc hazardous waste treatment facility that will be capable of treating in excess of 900,000 kg (2,000,000 pounds) per year during continuous operation has been designed and is currently under construction. The principal types of waste to be processed in the uit include paint (liquid and solidified), solvents (both halogenated and non-halogenated), and rags soaked with organic liquids. A treatability study conducted on waste paint using an existing plasma arc unit at Retech indicated that complete destruction could be achieved and that the emissions could comply with MACT standards. At present, work is in progress to complete an Environmental Impact Statement and to obtain RCRA RD&D and air permits. Under the current schedule, the unit should be operational in the Spring of 1998.

ACKNOWLEDGEMENTS

The authors gratefully acknowledge the following individuals who contributed information for this paper: Gary Koerber and Winoma Johnson of COMNAVBASE Norfolk Environmental Programs Department, Robert Waldo, Don Courter, and Bobbette Abraham of the Atlantic Division of NAVFACENGCOM; Dawn Roderique of TAMS Consultants, Inc.; Lisa Brown of Environmental and Safety Designs, Inc., and Ron Womack of Retech.

Figure 1. Schematic of the Plasma Arc Hazardous Waste Treatment System

Figure 2. Flowchart of the NEPA Process necessary to complete an Environmental Impact Statement

Jörgen Kyed

Consultant to TeamTech, No

Waste Management Technology aboard Ships using Advanced Incinerator Technology

ABSTRACT

The paper will include statistics on the worlds commercial and fishing fleets, number of people, waste quantities, waste management, incinerator arrangements, and short reference to International Regulations, advantage by on board incineration, etc.

Note:
Mr. Jörgen Kyed fell sick. The highlights of his paper were presented by Dr. Igor Vodyanoy

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Conditions

- **Golar IMO tests:**
  - IMO Class II waste
  - 78 kg/hr waste feed rate = 0.665 MBTU/hr
  - Aux fuel = Diesel at 1.530 MBTU/hr
    - Ratio aux fuel BTU/waste BTU = 2.3
- **Integrated Golar + Acoustic AB tests:**
  - 70% green waste + 30% plastics
  - Green waste has 10% moisture
  - 85.7 kg/hr = 2.10 MBTU/hr (3.15 times as much)
  - Aux fuel = Diesel + Propane at 1.73 MBTU/hr
    - Ratio aux fuel BTU/waste BTU = 0.8

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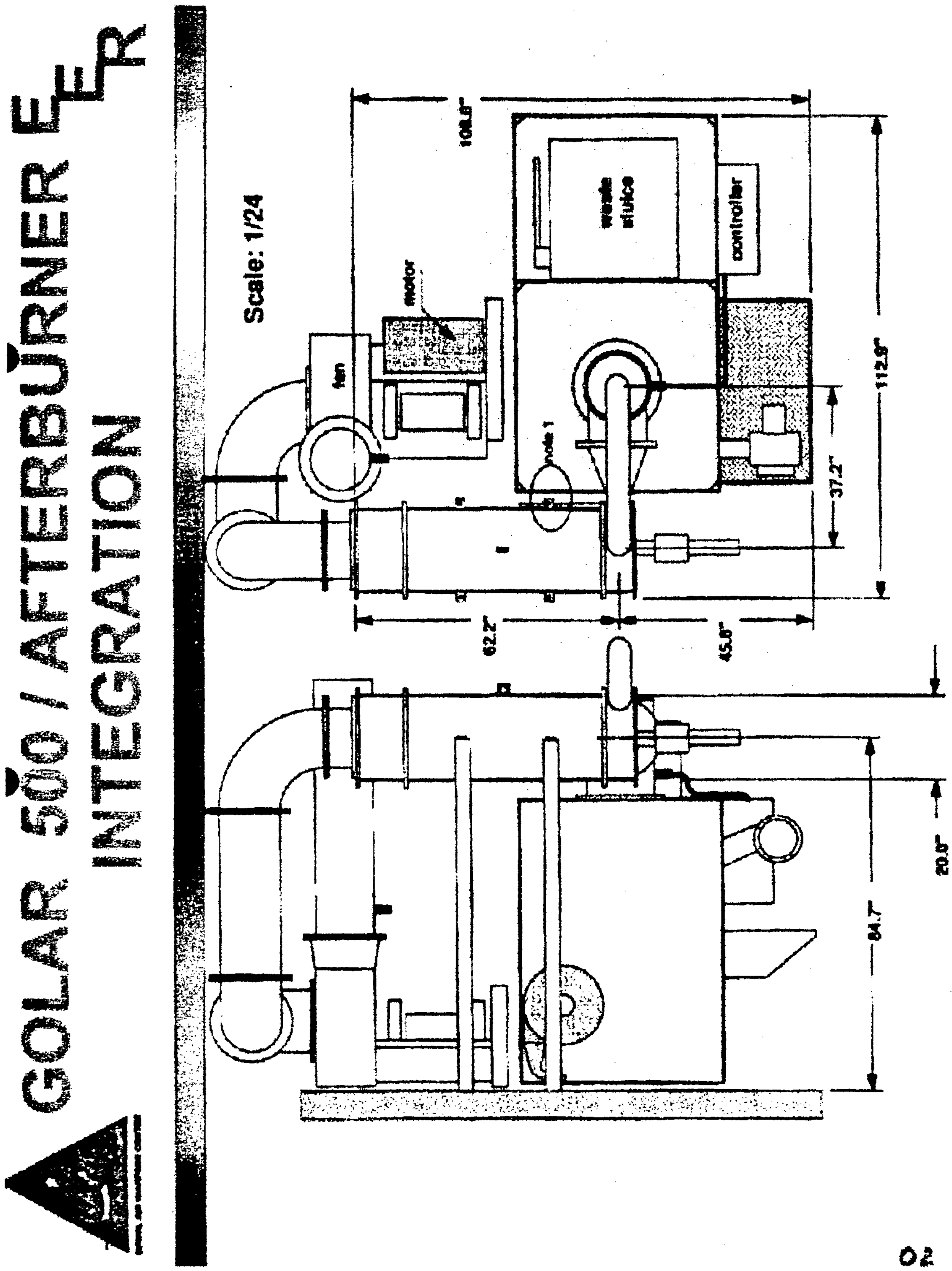

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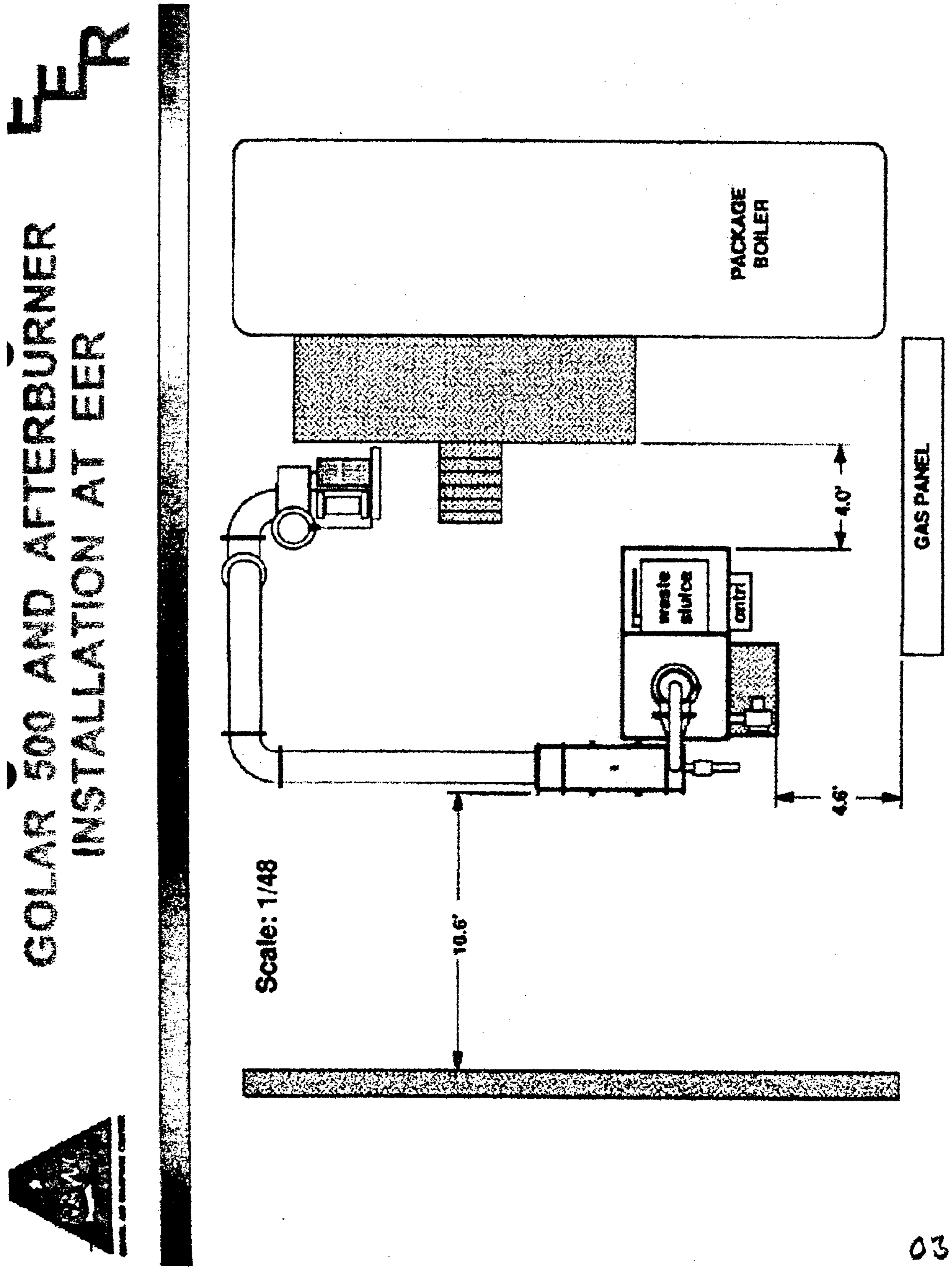
GOLAR 500 AND AFTERBURNER
INSTALLATION AT EER
Scale: 1/48
10.6'
4.0'
4.6'
PACKAGE BOILER
GAS PANEL
waste sluice
cntrl

03

S2P3-PICT04.JPG

Golär / Acoustic AB Integrated Performance

EER

Parameter	IMO Standard	Golar	Integrated Golar + Acoustic AB
CO ppm at 7% O_2	420	256	28
THC ppm at 7% O_2	NR	NR	1.2
Soot No.	3	2.8	<3 (no visible smoke)

04

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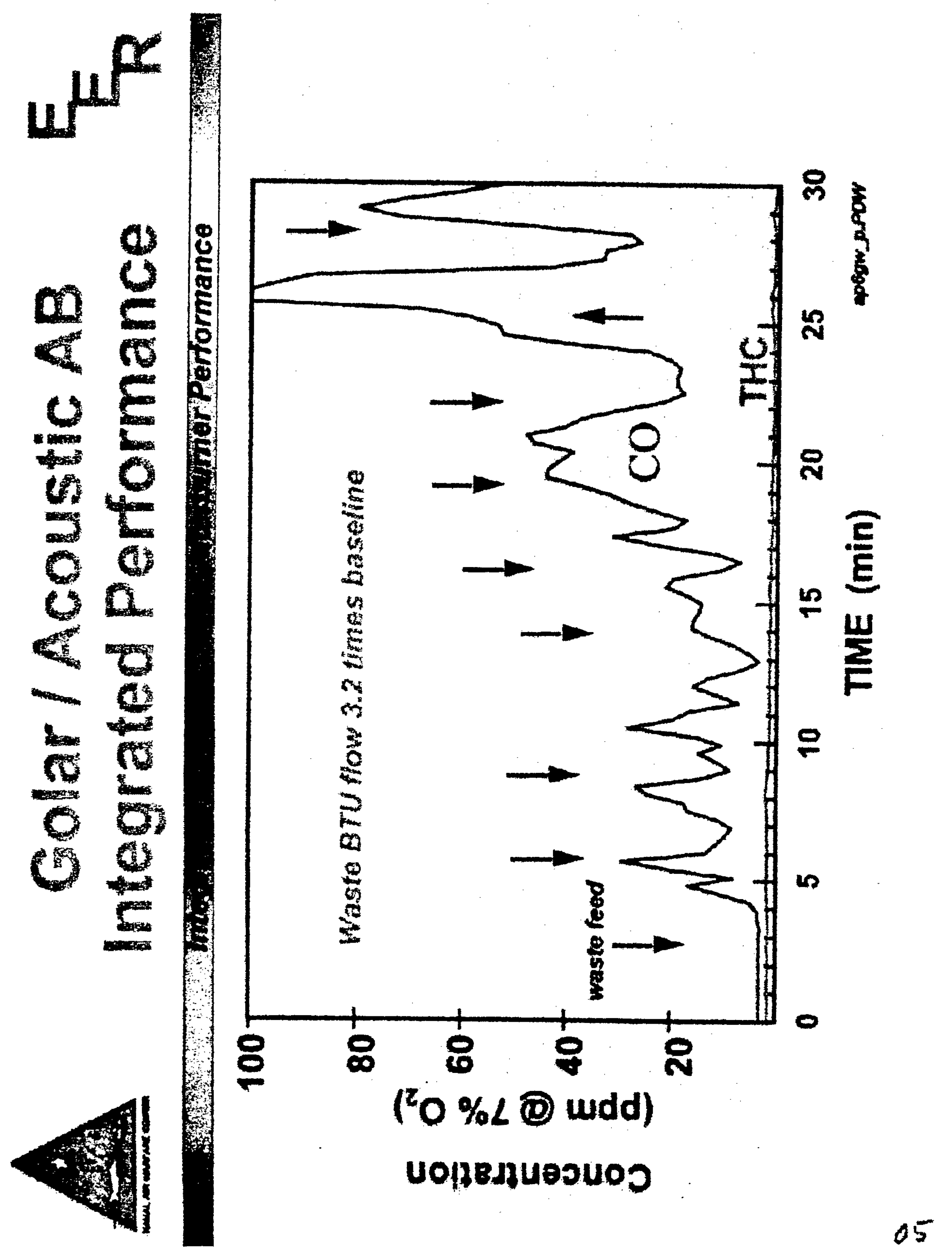

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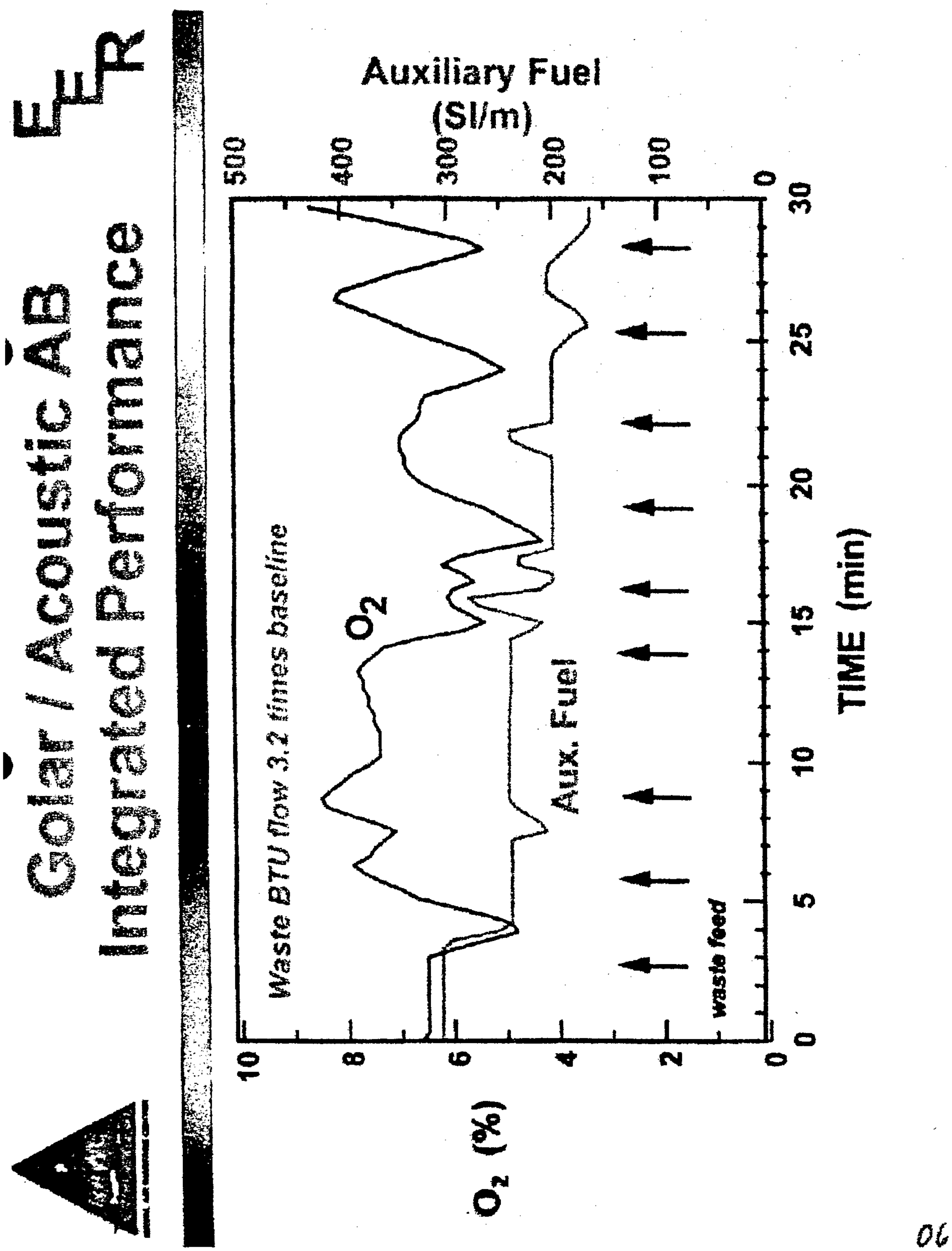

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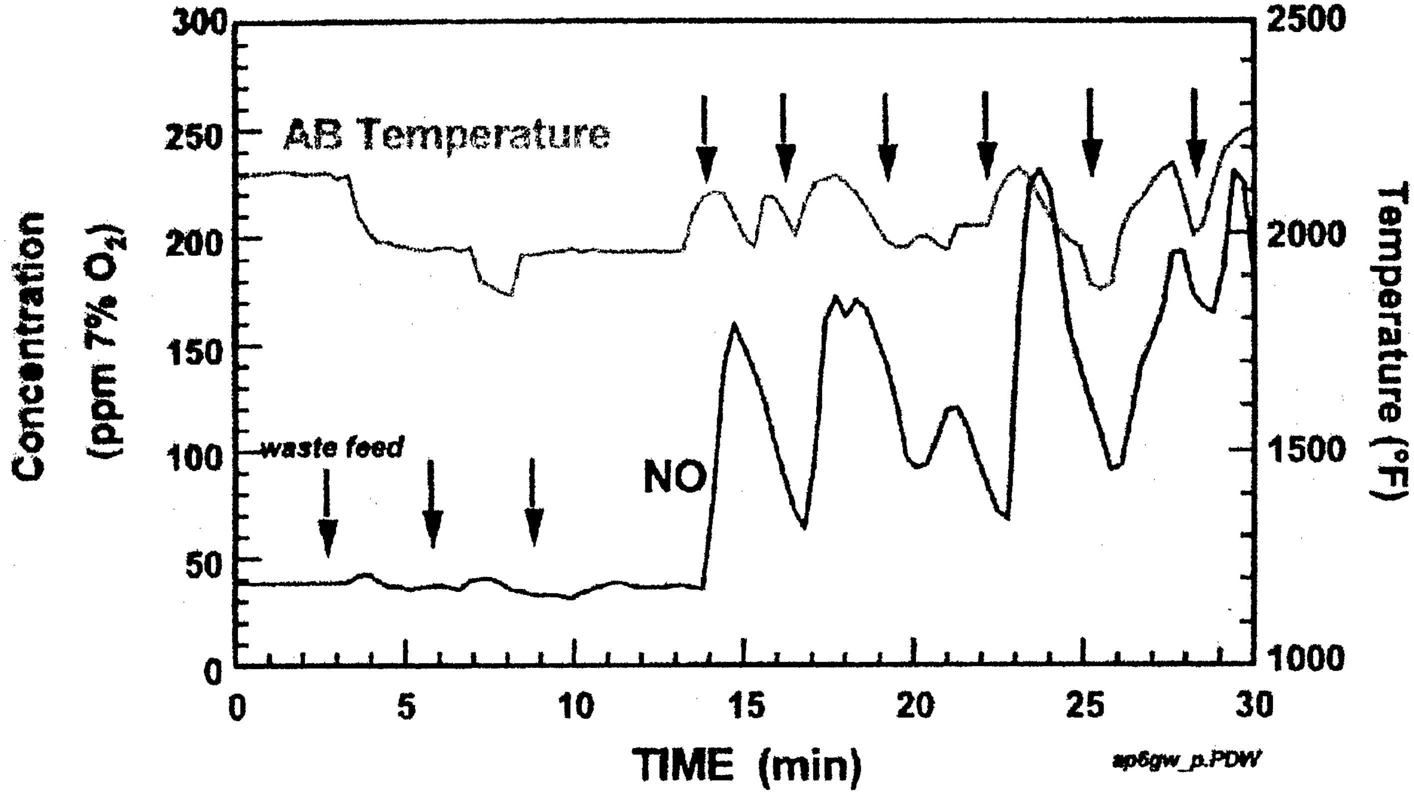
Golar / Acoustic ĀB Integrated Performance



07

Golar / Acoustic AB Integrated Performance

- Successfully increased waste BTU throughput by 3.2x while reducing emissions
- No visible smoke
- AB handled highly variable primary chamber output
  - Rapid puffs caused variable AB stoichiometry
- Closed loop control of auxiliary fuel would be required for best performance

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08

FACILITIES FOR WOMEN AT SEA
DEVELOPMENT OF AN ONBOARD TREATMENT SYSTEM

By Howard Clarke, Morgan Automation Ltd., UK

ABSTRACT

With the advent of women serving at sea in the UK Navy, a new form of sanitary waste has been created, which cannot be disposed of at sea.

A new toilet cubicle based system is under development for the treatment and disposal of waste under vacuum and then flush the small amount of remaining ash into the normal sewage waste system.

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FACILITIES FOR WOMEN AT SEA

DEVELOPMENT OF AN ONBOARD TREATMENT SYSTEM

FOR FEMALE SANITARY WASTE

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FEMALE SANITARY PRODUCTS

UK TOTAL MARKET (1990 FIGURES)

Sold	Approx Percentages	Millions
Press On Towels	37%	1110
Liners	19%	570
Tampons	44%	1320

2

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AVERAGE ITEMS PER FEMALE PER MONTH

PERIODS RANGE FROM 5-10 DAYS
AVERAGE PERIOD 7 DAYS

AVERAGE ITEMS PER DAY	**5**
AVERAGE ITEMS PER MONTH	**35**

3

S2P4-PICT04.JPG

QUANTITY OF WASTE

	FEMALE CREW	WASTE ITEMS PER MONTH	ITEMS BY TYPE	NUMBERS PER MONTH
FRIGATE	40	1400	PRESS TOWELS LINERS TAMPONS	518 266 616
AIRCRAFT CARRIER	150	5250	PRESS TOWELS LINERS TAMPONS	1942 998 2310

4

ALTERNATIVE TREATMENTS

1	**Collect, Store, Disposal on Shore**	**Present arrangement**
2	**Collect, Sterilise, Disposal on Shore**	
3	**Collect, Pressure Compact, (Volume Reduction), Disposal on Shore**	
4	**Collect, Wet or Dry Maceration, Disposal on Shore**	
5	**Complete Treatment Onboard**	

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SELECTION OF ONBOARD TREATMENTS

Incineration

Pyrolysis

Plasma Processes

Chemical Treatment

Microwave/RF Processes

Biological Processes

6

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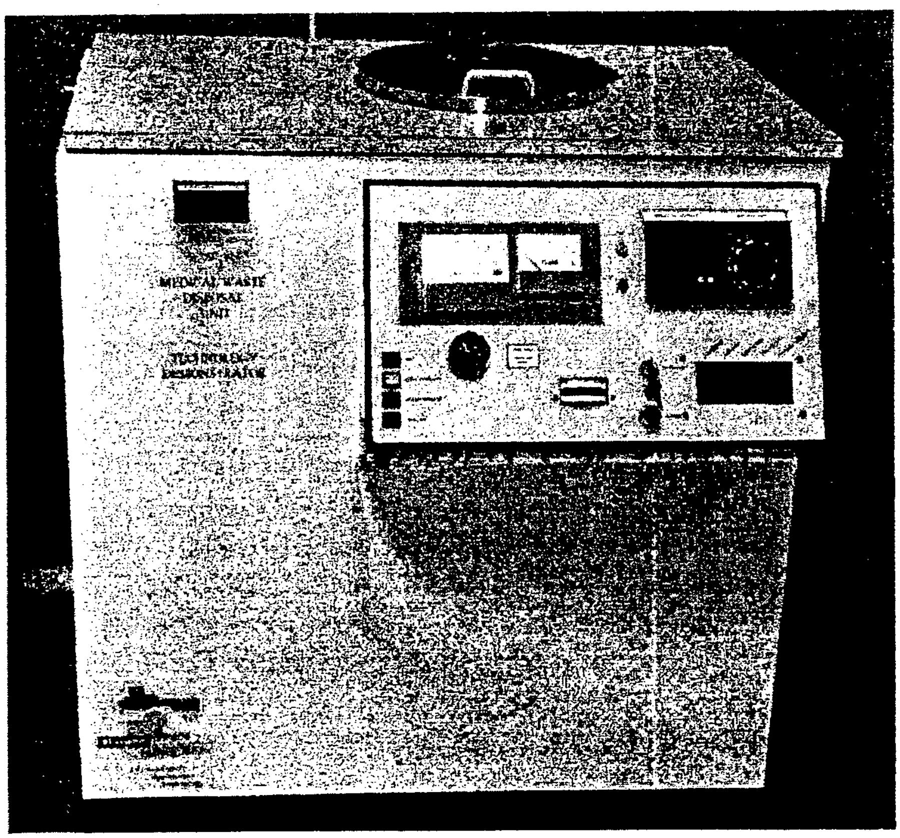
TECHNOLOGY
Patent Nos: 2289324, 2310485
Further Patents applied for
DEMONSTRATOR



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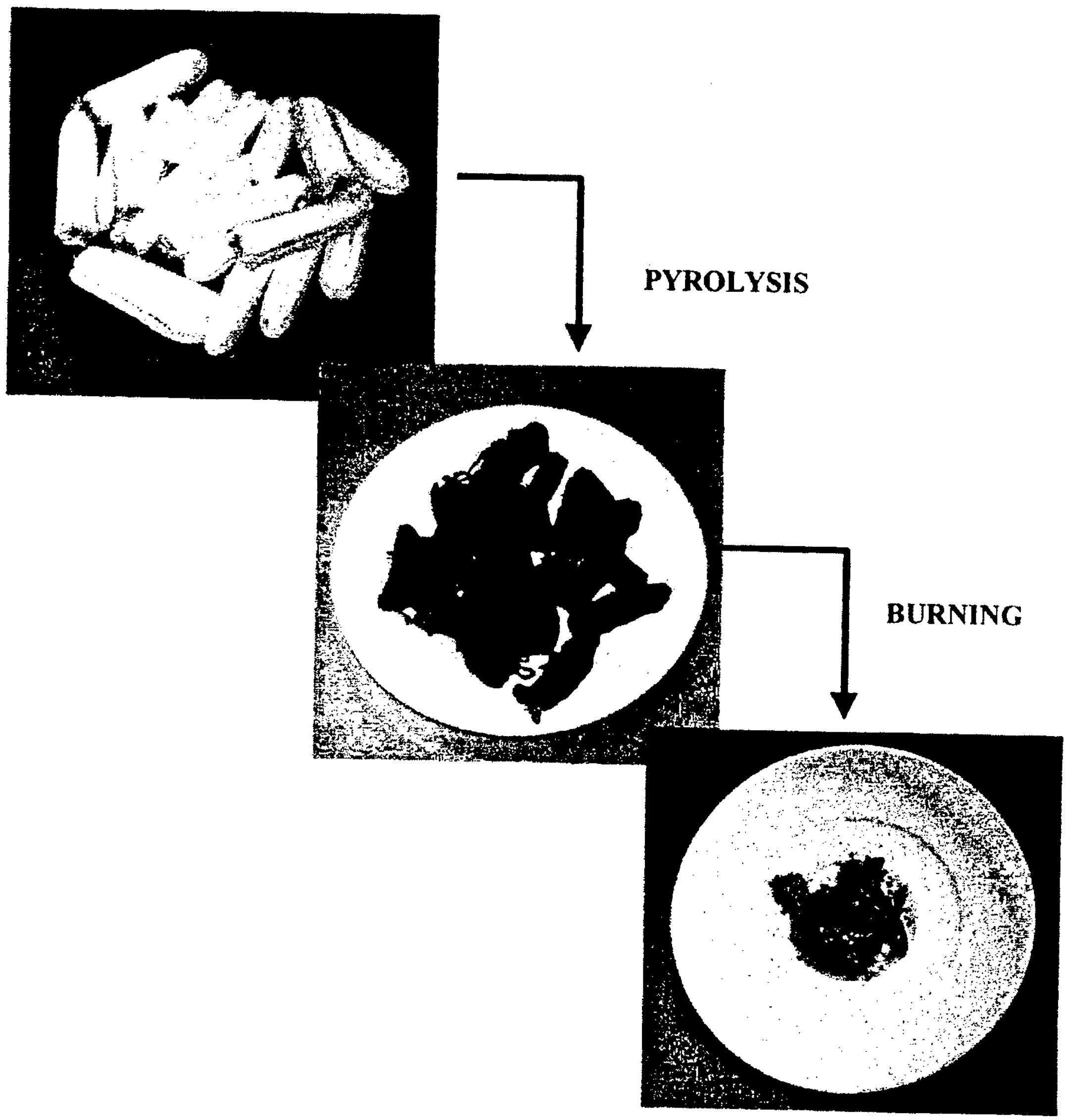
WHAT HAPPENS



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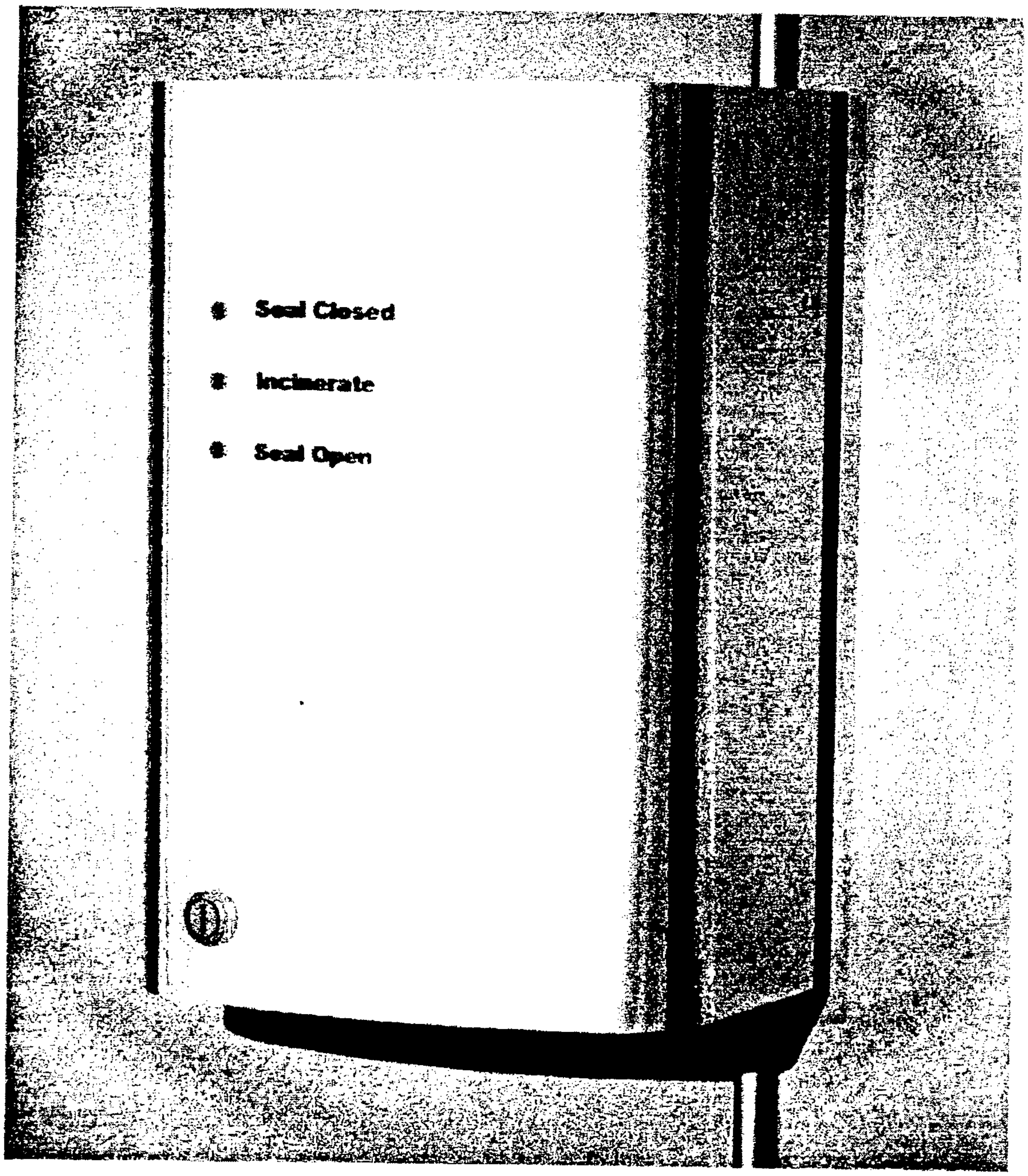
Sanitary Waste Treatment Unit

The Control Unit



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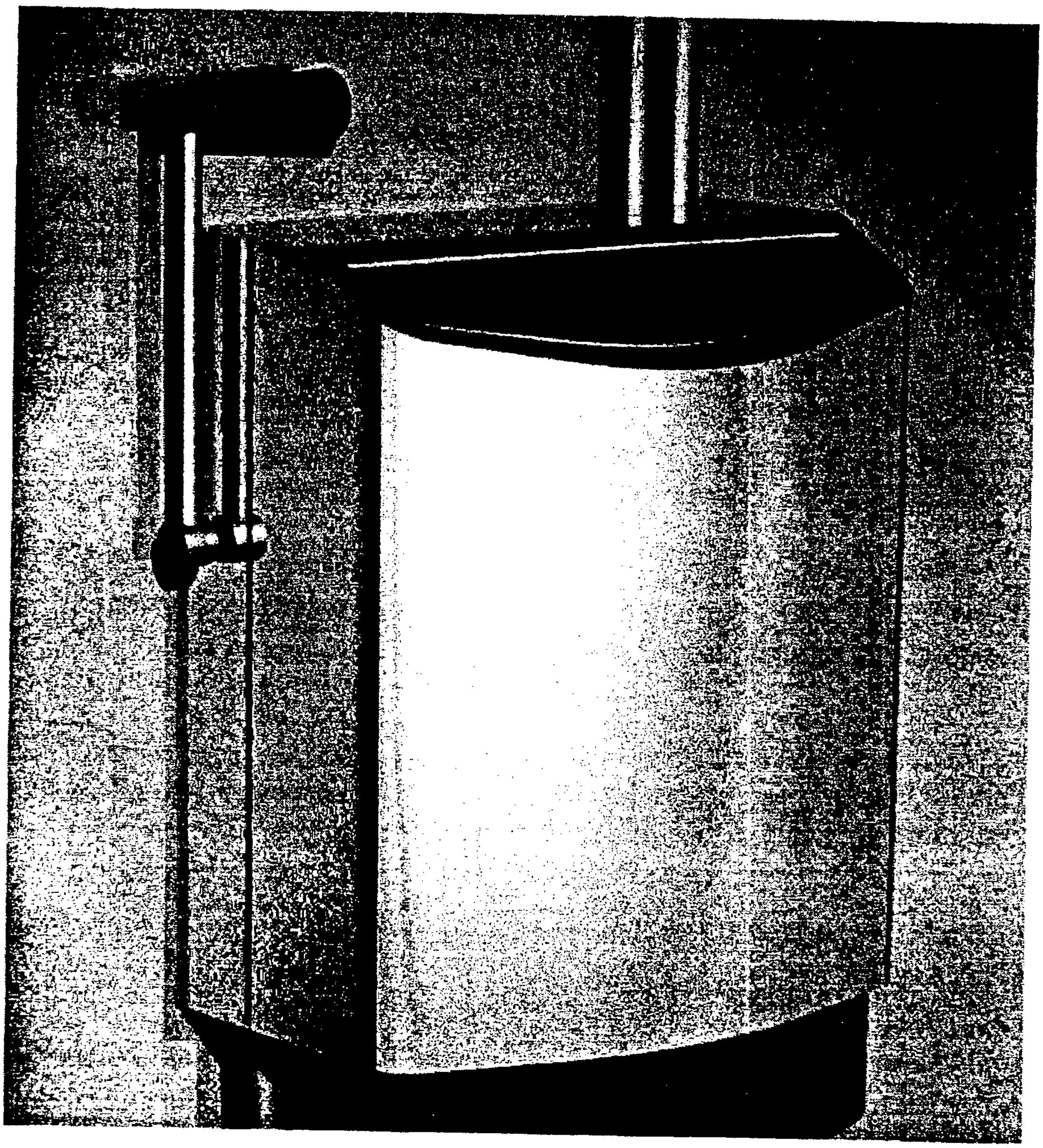
Sanitary Waste Treatment Unit

The Processing Unit



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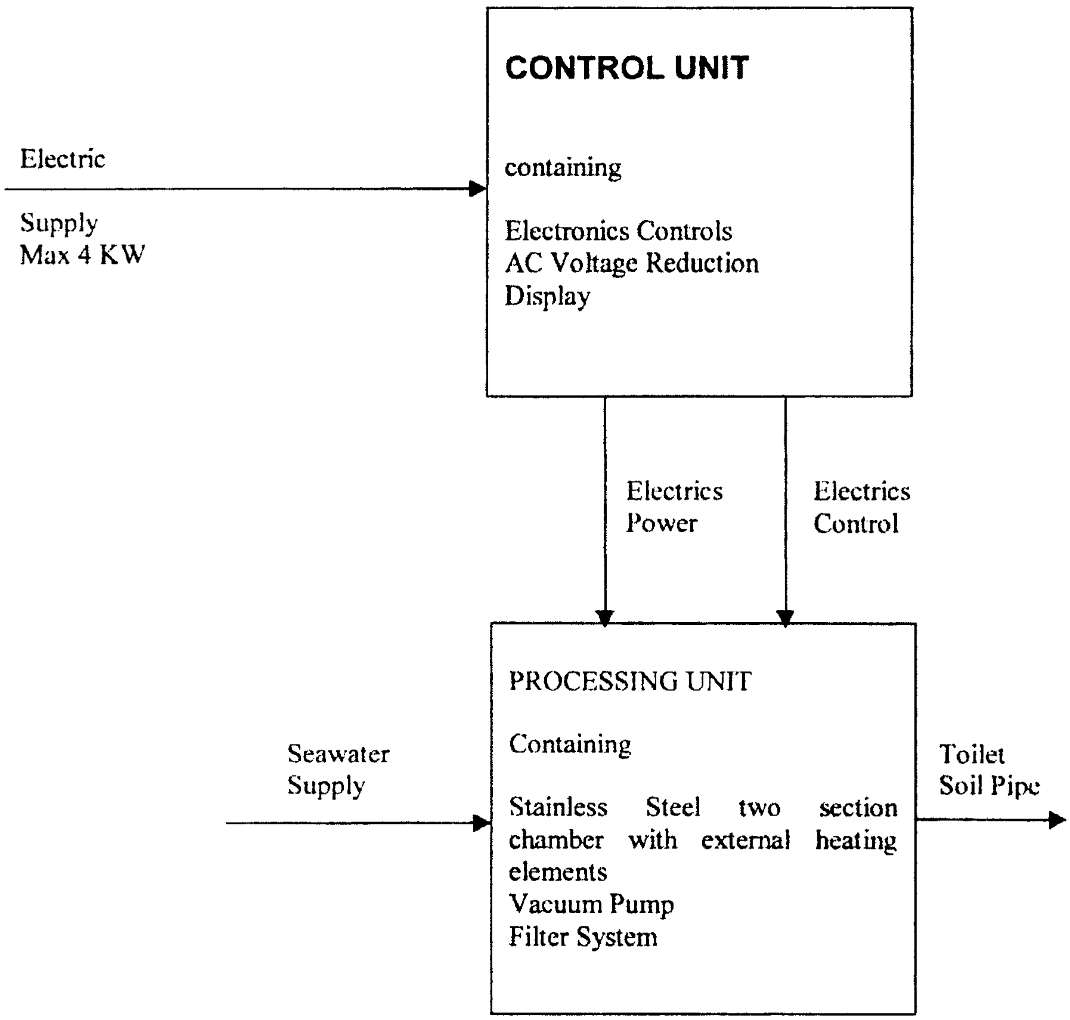
SANITARY WASTE TREATMENT UNIT

INTERCONNECTION OF UNITS



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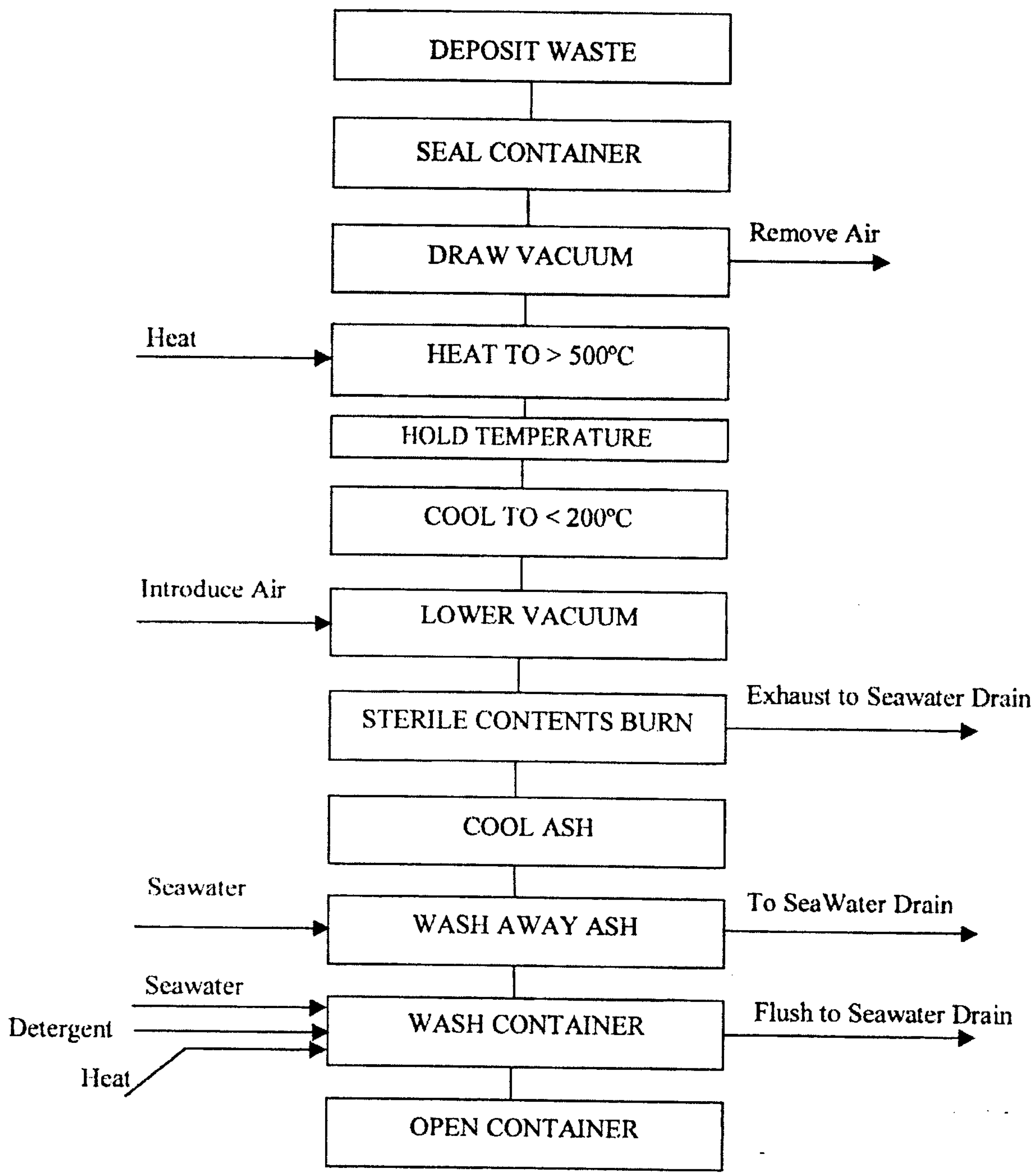
TREATMENT PROCESS



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• The Maritime Environment •

"Thermal Waste Treatment Technologies for Ships"

Session 3

Mechanical Waste Treatment Technologies

Session Chairman: Mr. Joel Krinsky, Naval Sea Systems Command, US

Session 3– Mechanical Waste Treatment Technologies

Session Chairman Mr. Joel Krinsky, Naval Sea Systems Command, US.

Ladies and Gentlemen, I introduced **Mr. Joel Krinsky** as a Speaker yesterday, so there is no need to introduce him again. Mr. Krinsky has kindly agreed to take the chair of Session three since

Mr. Kari Rinne, President of Taifun Engineering Oy Ltd., Helsinki, FI,

the designated chairman could not make himself available for this conference.

Paper 1: Mr. Marten Bärlund, TAIFUN Engineering Oy, FI

I like to introduce Mr. Marten Bärlund, Sales Manager from TAIFUN Engineering Oy, FI

He graduated as Naval Architect and as HVAC-Engineer at the Swedish Institute of Technology, Helsinky in 1998.

In 1995 he became Project Engineer, in 1997 he became Sales Engineer and in 1998 he became Sales Manager for the Baltic Sea Region at Hackman Metos Marine which is one of the leading galley equipment supplier.

He will present a paper on

Food Waste Management System Taifun

Paper 2: Joel Krinsky, Naval Sea Systems Command, US

I will now present a paper on

U.S. Navy Solid Waste Equipment Program

Paper 3: Uwe Wittkamp, Lindau Entsorgungstechnik GmbH, GE

Mr. Uwe Wittkamp is the CEO of Lindau Entsorgungstechnik GmbH, GE

After his studies of Technical Engineering at the Technical University of Aachen, GE, he gained a Job-Expirience as follows:

1988-1989	Production Manager at Voss GmbH, GE Processing of minerals; shredding, seveing, conveying, storing, packing
1989-1993	Manager for Tecchnical Construction at Möllers GmbH, GE Automatic packing, bagging, palletizing, and conveying systems for chemical-, cement- and food-industry
1993	Foundation of Lindau Entsorgungstechnik GmbH Special environmental plants and technology for waste handling; shredder, crusher, compactors, chute systems, conveyors for land and shipborne applications

Mr. Wittkamp will introduce a paper titled:

Waste Management Making Use of Shredders, Glass Crushers, Compactors, and Densifiers

Paper 4: Jochen Deerberg, DEERBERG-SYSTEMS, GE

Mr. Wolfgang Zillgith from Hobarth GmbH, GE, has produced the following paper on

Waste Mangement utilizing Pulpers and Waterpress

Unfortunately he had to go on a unforeseen business trip, also to the far east.

His paper will be presented by Mr. Jochen Deerberg the CEO of DEERBERG-SYSTEMS, GE, who closely cooperated with Mr. Zillgith.

Mr. Deerberg is a sponsor of this conference and we owe him our thanks for the delicious dinner last night.

Mr. Deerberg worked as an assistant to the owner of Martin Merkel, Hamburg, and was responsible for Organisation and the ADP Department, for Public Relation, Special Customer Service, and Trouble Shooting.

In 1974 he became Manager for Controlling, Organisation, ADP and Centralisation of AEG, Oldenburg.

In 1979 he founded DEERBERG-SYSTEMS Concultancy, in 1983 he founded DEERBERG-SYSTEMS Waste Management and in 1985 he founded DEERBERG TRADING a general trading company.

Mr. Deerberg will now present the paper of Mr. Zillgith.

Food Waste Management System Taifun

Presenter: Maarten Bärlund, Taifun Oy

ABSTRACT

Taifun Food Waste Management System: a cleaner, simpler and more environmental friendly food waste conveying system for cruise ships

Today's more strict environmental aspects is driving the industries to more effective and better solutions to save the environment. Taifun wants to share the burden and has therefore developed the Taifun Food Waste Management System.

The system is based on vacuum conveying technology for food waste/wet garbage, which is more energy saving than the conventional systems on the market. The Taifun system uses only a small amount of water and no additives are needed to prevent unpleasant odours and bacteria growth.

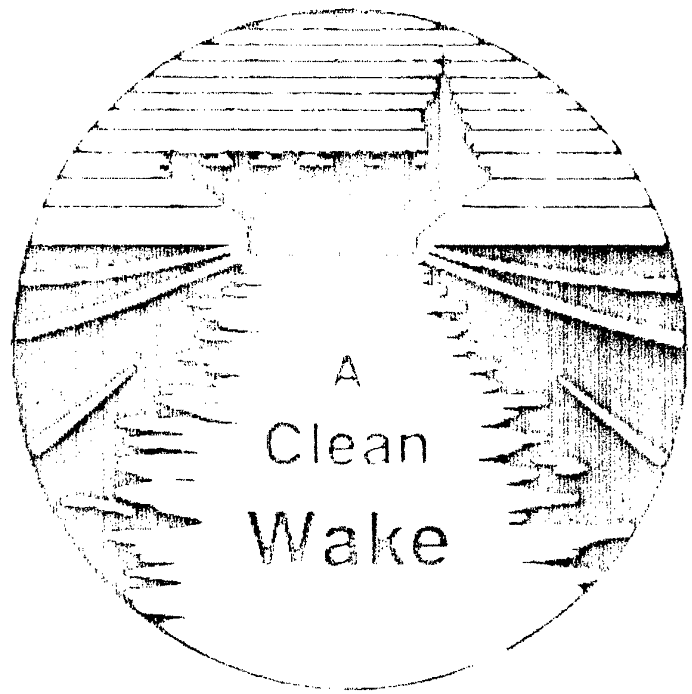
The workstations/hoppers can be tailor made in order to achieve the best possible working ergonomics and gives the opportunity for the galley layout to build a more effective food preparation process.

In December 1998 Taifun Engineering and Kvaerner Masa-Yards, Helsinki, Finland signed a contract for the delivery of Taifun Food Waste Management System to convey the wet garbage/food waste from galleys and pantries to the incinerator room. The system will be installed onboard Costa Cruises NB 498: M/V Costa Atlantica, Carnivals NB 499: M/V Carnival Spirit and the upcoming sister ships in that series.

U.S. Navy Solid Waste Equipment Program

Naval Surface Warfare Center CARDEROCK DIVISION

Naval Sea Systems Command



22 April 1999

Mr. Joel Krinsky

US Navy, Naval Sea Systems Command, SEA 03L1

703-602-0547 ext.250

krinskyjl@navsea.navy.mil

The Problem

Naval Surface Warfare Center
CARDEROCK DIVISION
Naval Sea Systems Command

STORAGE OF SOLID WASTE SHIPBOARD EFFECTS THE SAILORS QUALITY OF LIFE

The Problem

Naval Sea Systems Command

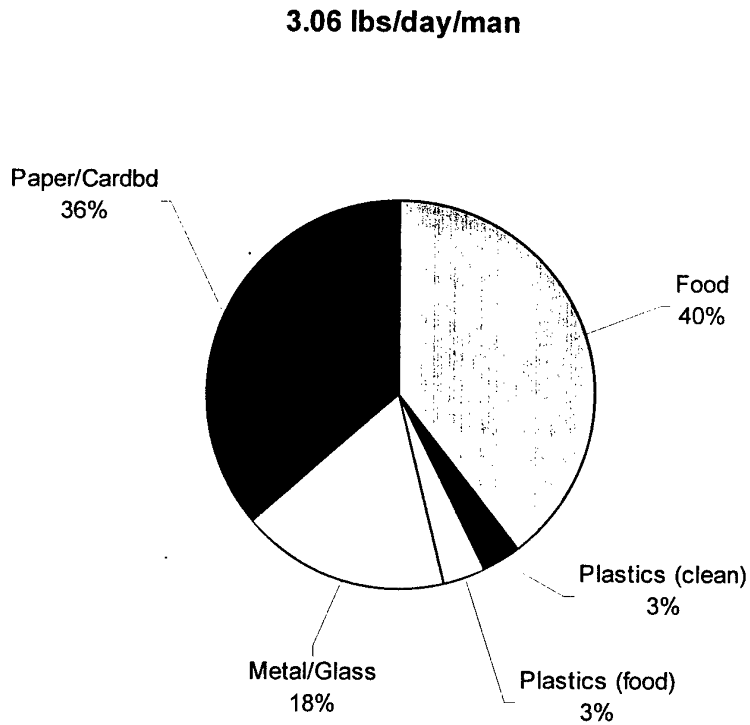
NSWC Naval Surface Warfare Center CARDEROCK DIVISION

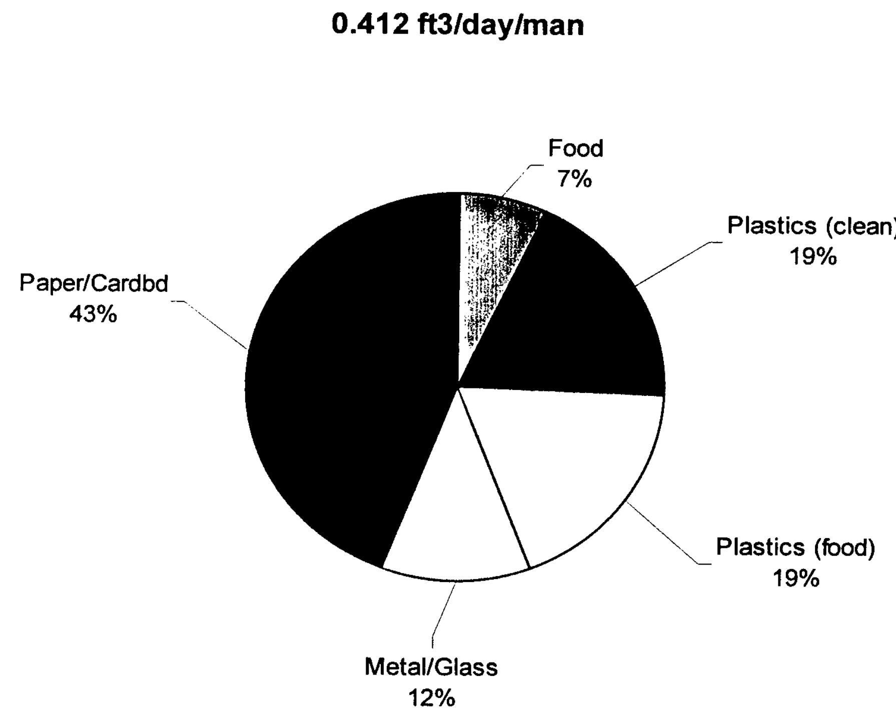
STORAGE OF SOLID WASTE SHIPBOARD EFFECTS A SHIP'S OPERATIONAL READINESS

SOLID WASTE GENERATION RATES

Naval Surface Warfare Center CARDEROCK DIVISION

Naval Sea Systems Command





Navy Solid Waste Legislation

PLASTICS WASTE

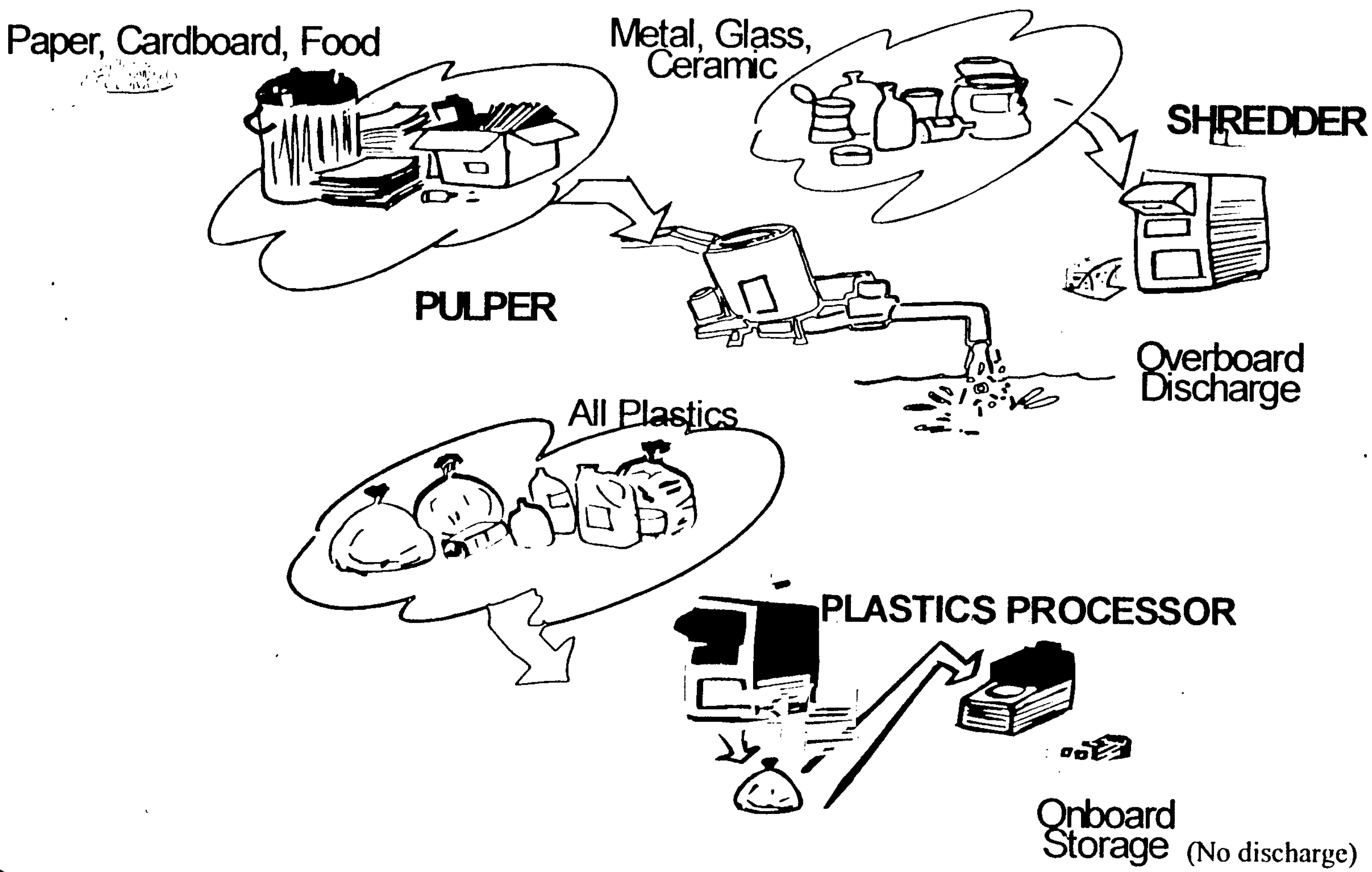
- Marine Plastic Pollution Research & Control Act (1987)
  - Implemented Annex V of MARPOL 73/78 for public vessels as of Jan 1994
    - No discharge of plastics anywhere
- National Defense Authorization Act for Fiscal Year 1994, Section 1003
  - Established Plastics Waste Processor (PWP) program milestones
  - Submarine compliance set for Dec 2008

NON-PLASTICS SOLID WASTE

- National Defense Authorization Act for Fiscal Year 1997, Section 324
  - Compliance with discharge restrictions in "special areas" by Dec 2000
  - Allows use of Navy-developed pulpers & shredders in "special areas"
- Navy's Compliance Plan forwarded to Congress (SECNAV ltr of 25 Nov 1996)
  - Install pulpers & shredders on all warships, FFG-7 and larger by Dec 2000
  - Pulp and shred everywhere at sea

U.S. Navy's Solid Waste Compliance Plan

Naval Surface Warfare Center CARDEROCK DIVISION
Naval Sea Systems Command



US NAVY SHIPBOARD SOLID WASTE SOLUTIONS

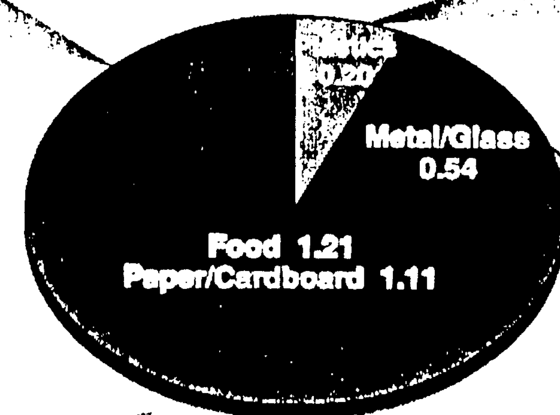
NSWC
Naval Surface Warfare Center
CARDEROCK DIVISION
Naval Sea Systems Command

SHIPBOARD SOLID WASTE GENERATION

3.06 lbs/day/man

Small Pulper

Large Pulper



Plastics Processor

Metal/Glass Shredder

NAVY SHIPBOARD REQUIREMENTS

Naval Sea Systems Command

Constrained By

- ***Performance***
- Size & space
- Weight
- Reliability
- Maintainability
- Manning
- Shock and vibration
- "Environmental" factors
- Electromagnetic compatibility
- Acoustics
- Noise
- Ship systems integration
- Ship's services
- Safety & health
- Survivability

Land-based technologies & commercial off-the-shelf waste management equipment typically unsuitable for Navy shipboard installation & operation

SHIP IMPACTS TO BE ADDRESSED

Naval Surface Warfare Center CARDEROCK DIVISION
Naval Sea Systems Command

- Arrangements
  - Footprint, height, volume
  - Number of decks
  - Displacement of vital, mission-critical, or machinery systems
  - Adjacency to waste sources, crew & waste traffic flows
- Weight & stability
- Structural modifications
  - Get equipment into ship
  - Installation
  - Interface with ship services
  - Relocate displaced spaces & functions
- Electrical systems
  - Power loads
  - Power distribution system
- HVAC systems
  - Ventilation & cooling
  - Pressure balancing
  - Chemical, biological, & radiation protection system integrity
- Fluid systems
  - Water (fresh/sea, hot/cold)
  - Hydraulic
  - Fuel oil
  - Steam & condensate
  - Drainage
- Firefighting
  - Firemain
  - Other extinguishing agents & systems
- Alarms & control systems
- Outfitting (space prep)

- Secondary wastes treatment/disposal
- Processed/secondary waste stowage for offload or discharge
- Manning
  - Equipment operation & maintenance
  - Waste sorting, movement, stowage, offload
- Health & safety
  - Fire & explosion
  - Toxic & hazardous substances
  - Mechanical & other physical hazards
  - Trash & residue handling
- Ship signatures (infrared, acoustic, electromagnetic)
- Survivability & damage control
  - Fire
  - Explosion
  - Flooding
  - Shock
  - Vibration
  - Hazardous/toxic atmospheres
- Electromagnetic compatibility (EMI/EMC)
- Military mission/operations/readiness
- Habitability & morale
- Costs
  - Ship alteration (SHIPALT) design
  - Procurement
  - Installation
  - Operation
  - Maintenance/repair & logistic support
  - Programmatic

SOLID WASTE EQUIPMENT DESIGN APPROACH

Naval Sea Systems Command

- Equipment "hatchable"
- Modular Compress-Melt Unit
- Common shredder design for plastics and metal/glass
- Geometrically-similar pulpers
- Commercial components / specifications where appropriate
- Common vendor items
- Manufacturability reviews
- Human engineering integrated
- All failures / deficiencies corrected / addressed

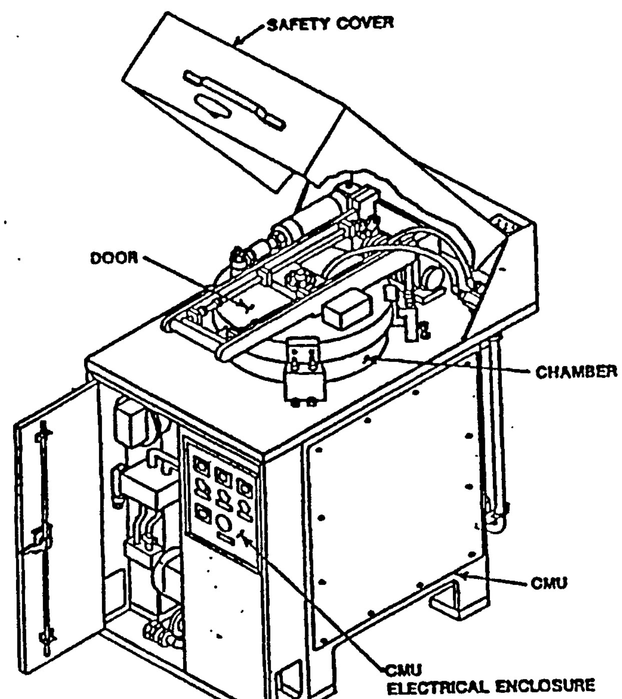
INTEGRATED LOGISTICS SUPPORT (ILS) Elements
Addressed in Program Planning
--Many Tailored--

Naval Sea Systems Command

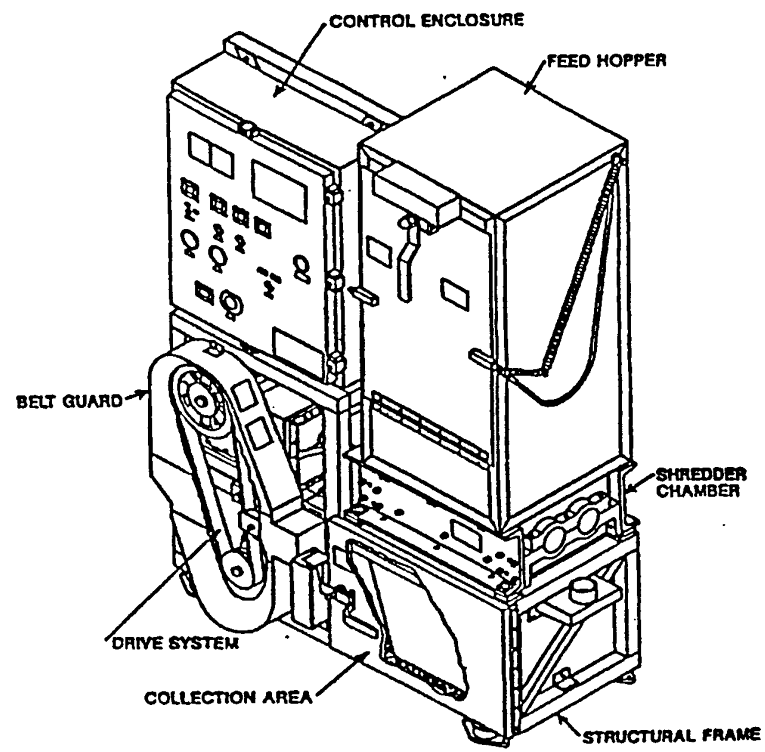
- Failure Modes, Effects, & Criticality Analysis
- Level of Repair Analysis
- Reliability Centered Maintenance Analysis
- Identification of Human Engineering Requirements
- Navy Training Plan
- Quality Assurance Plan
- Systems Safety Plan
- Preliminary Hazard Analysis
- Safety Assessment
- Technical Manual Validation Plan
- Support Equipment Requirements List
- Support Equipment Stowage Requirements
- New Equipment Calibration Requirements
- Technical Manual
- Depot Plan
- Calibration Procedure
- Definition of Maintenance Facilities Requirements
- Packaging, Handling, Storage & Transportation Requirements
- Supply Support Packaging, Handling, Storage & Transportation
- Task / Skill Analysis
- Human Engineering Analysis
- Reliability Centered Maintenance Preventive Maintenance Schedule
- Source, Maintenance & Recoverability Codes
- Allowance Equipage List
- Allowance Parts List
- Develop Training Material
- Provisioning Technical Documentation

Plastics Waste Processor (PWP)

Naval Sea Systems Command



Compress Melt Unit
(25.5"W x 49.5"D x 45.75"H)

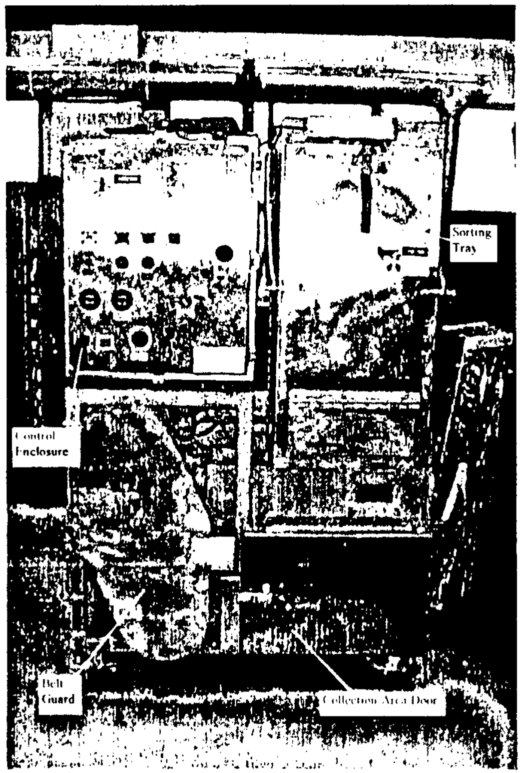


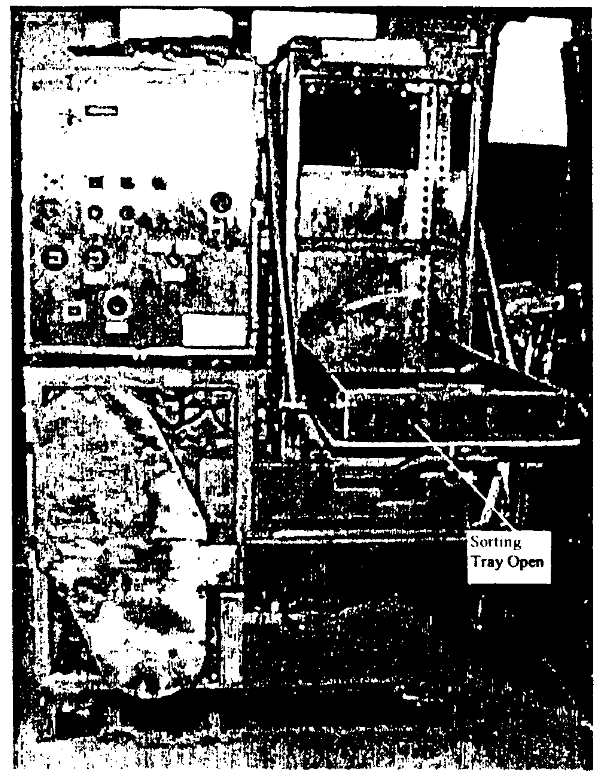
Shredder
(51.75"W x 25"D x 76.75"H)

Plastics Shredder

NSWC Naval Surface Warfare Center CARDEROCK DIVISION

Naval Sea Systems Command

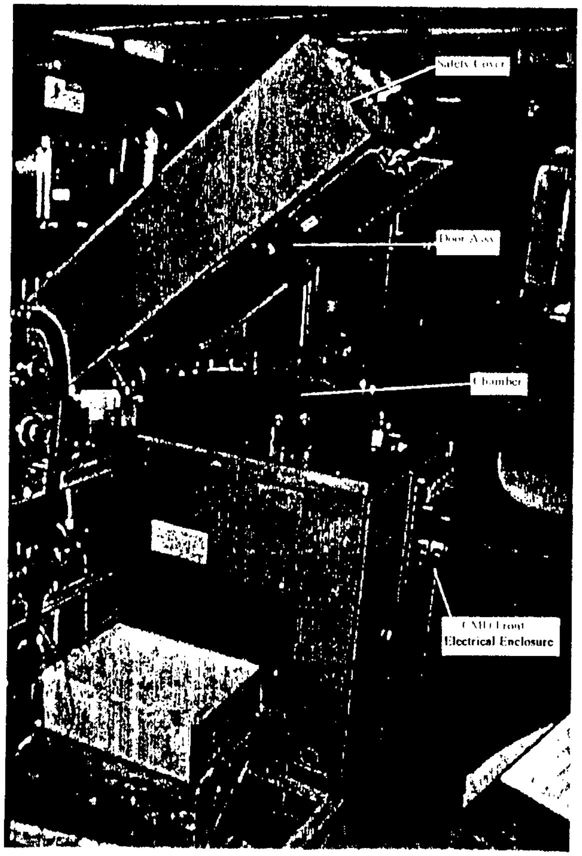




Batch loaded plastic waste is torn apart and "homogenized"

Compress Melt Unit (CMU)

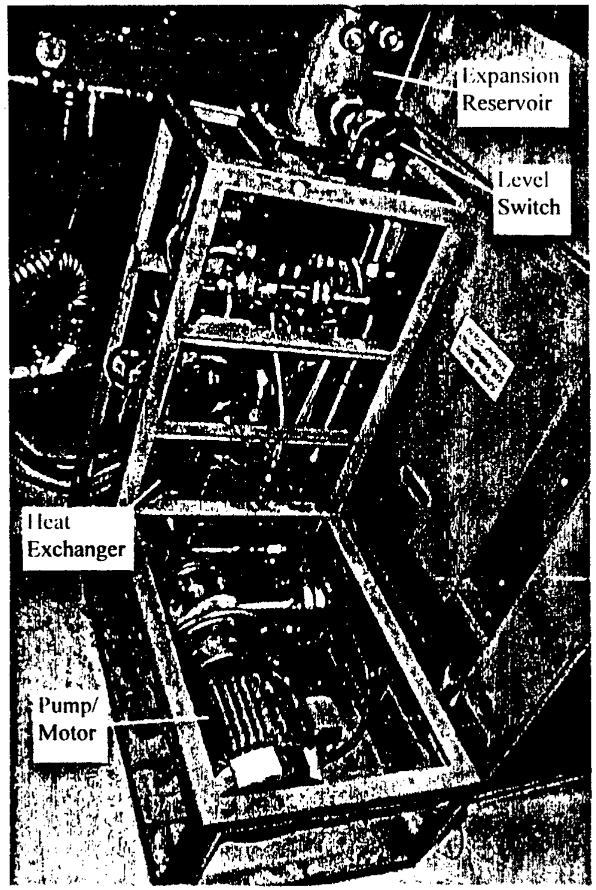
NSWC Naval Surface Warfare Center CARDEROCK DIVISION
Naval Sea Systems Command



- A combination of heat and pressure convert commingled plastic waste along with the all non-plastic contamination into a stable, sanitized 20 inch diameter disk.
  - A vertically mounted ram compresses the plastic against the chamber door
  - The ram, chamber and door are heated and them cooled to optimize the process
  - Once loaded the processes is controlled and monitored by a programmable logic controller

Closed Loop Cooling Unit (CLCU)

Naval Sea Systems Command

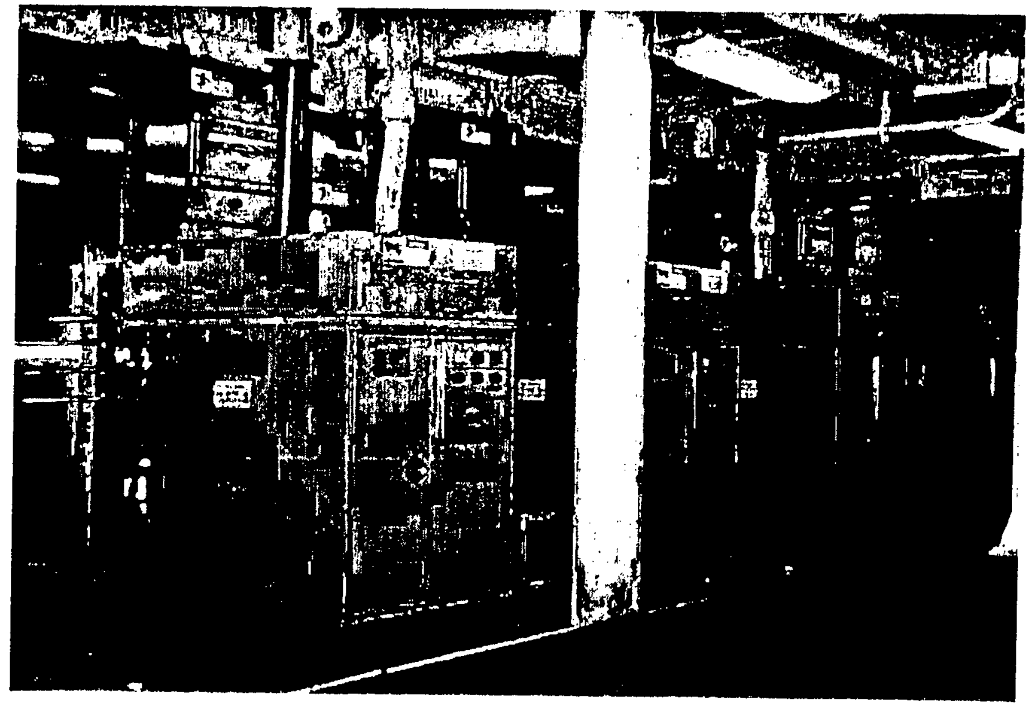


- Heat is removed from the waste plastic disk and CMU and transferred to cooling water via a seawater heat exchanger.
  - Use of chilled water instead of salt water is acceptable

PWPs in the Fleet

Naval Surface Warfare Center CARDEROCK DIVISION

Naval Sea Systems Command



PWP Lab Testing and Evaluation

Naval Surface Warfare Center CARDEROCK DIVISION
Naval Sea Systems Command

- Process Optimization Tests
- Foreign Object Tests
- Component Life Cycle Tests
- Heating and Cooling Load Experiments
- Sensor / Control System Experiments
- Material Analysis
- Human Factors Experiments
- Ventilation Experiments
- Failure Mode Experiments

PWP Shipboard Testing and Evaluation

Naval Sea Systems Command

Ships	Crew Size	Units Installed CMUs	CLCUs	Plastics Shredders	Disks Produced	Waste (lbs)
USS George Washington CVN 73	5,500	4	3	2	29,095	243,533
USS John C. Stennis CVN 74	5,500	4	3	2	21,563	181,560
USS Constellation CV 64	5,500	11	6	2	3,764	32,031
USS Vandegrift FFG 48	220	2	1	0	740	7,193
USS Kearsarge LHD 3	3,100	2	1	1	1,608	12,864
USS Wasp LHD 1	3,100	2	1	1	6,100	52,596
Total		**25**	**15**	**8**	**62,870**	**529,777**

PWP Acquisition and Installation Milestones

Naval Sea Systems Command

National Defense Authorization Action for FY94, Section 1003

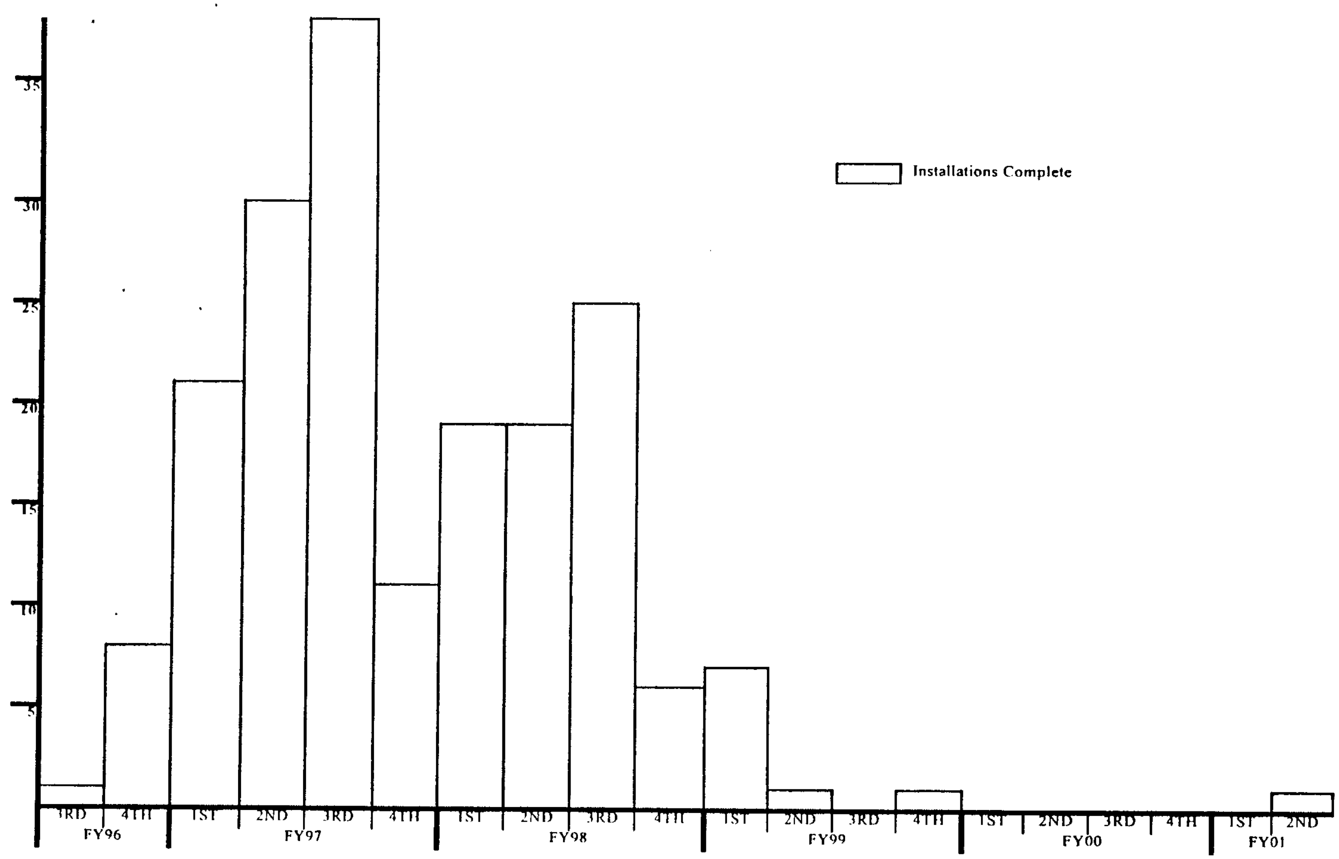
	Not Later Than
Release RFP	10/01/94 ✓
Install first production unit on ship	07/01/96 ✓
Install on 25% of ships*	03/01/97 ✓
Install on 50% of ships*	07/01/97 ✓
Install on 75% of ships*	07/01/98 ✓
Install on 100% of ships*	12/31/98 ✓

* Ships that require Plastics Processor for legislative compliance.

(Approximately 190 ships, based on decommissioning schedule and new ship construction)

PWP Installation Status

Naval Surface Warfare Center CARDEROCK DIVISION
Naval Sea Systems Command



PLASTICS PROCESSOR
Specifications

- **Base system: 3 CMUs, 2 CUs and 1 PS**
  - **Processing Rate: 30 pounds per hour**
  - **Mean Time Between Critical Failure (MTBCF): >400 hours**
  - **Mean Time to Repair (MTTR): <4 hours**
  - **Mean Logistics Delay Time (MLDT): < 8 hours**
  - **Maximum Down Time (Mmax): <12 hours**

CMU & CU SHIPBOARD INTERFACE REQUIREMENTS

NSWC Naval Surface Warfare Center CARDEROCK DIVISION
Naval Sea Systems Command

Requirement	CMU	CU
Electrical	440 Volts alternating currnt, 3 Phase, 60 Hertz, 50 Amperes	440 Volts alternating current, 3 Phase, 60 Hertz, 15 Amperes
Seawater	N/A	30 Gallons per Minute
Ventilation	100 cubic feet per minute (cfm)	N/A
Low Pressure Air	1.5 cubic feet per minute at 80-125 pounds per square inch per CMU	N/A
Equipment Drain	One for every two CMUs	N/A
Foundations	Certified to Grade B Shock	Same as CMU
Pad eye	One over each CMU	N/A

Naval Sea Systems Command

PLASTIC SHREDDER (PS) AND HEAT SEALER SHIPBOARD INTERFACE REQUIREMENTS

NSWC Naval Surface Warfare Center CARDEROCK DIVISION
Naval Sea Systems Command

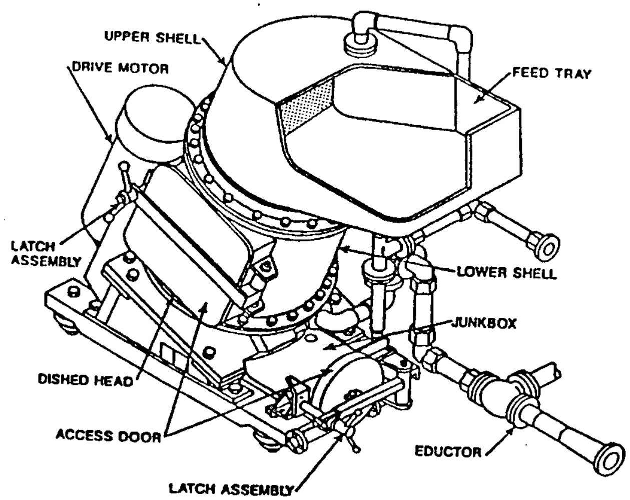
Requirement	PS	Heat Sealer
Electrical	440 Volts alternating current, 3 Phase, 60 Hertz, 25 Amperes	120 Volts alternating current, 1 Phase, 60 Hertz, 3 Amperes
Ventilation	100 cubic feet per minute	N/A
Equipment Drain	One for every PS	N/A
Foundations	Certified to Grade B Shock	*

***Heat Sealer Foundations shall also be designed to allow for quick removal and stowage of HS prior to space wash down. The HS is NOT waterproof.**

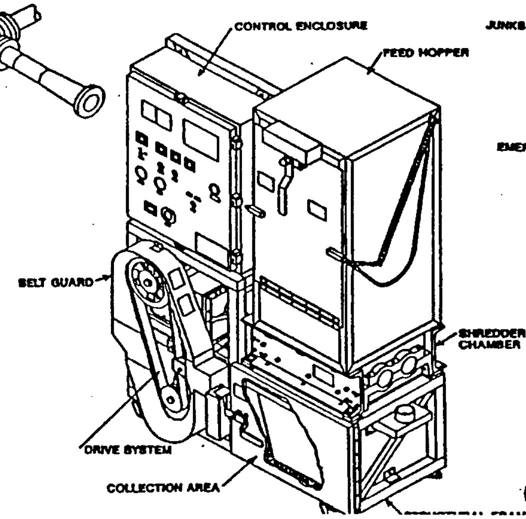
OBBs should be bulkhead mounted on a roll dispenser.

Pulpers & Shredders

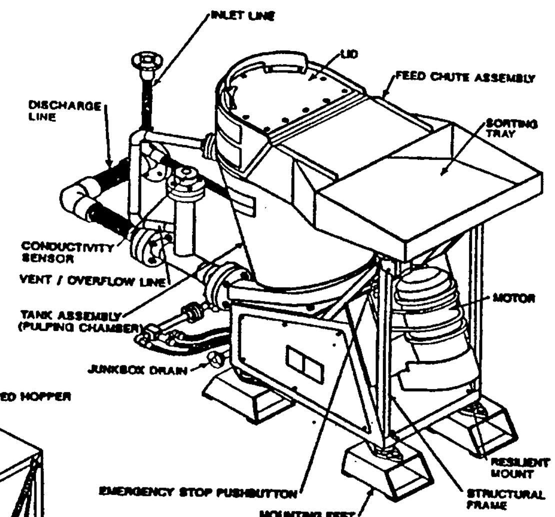
Naval Sea Systems Command



Large Pulper
(85.38"W x 67"D x 70.25"H)



Shredder
(51.75"W x 25"D x 76.75"H)



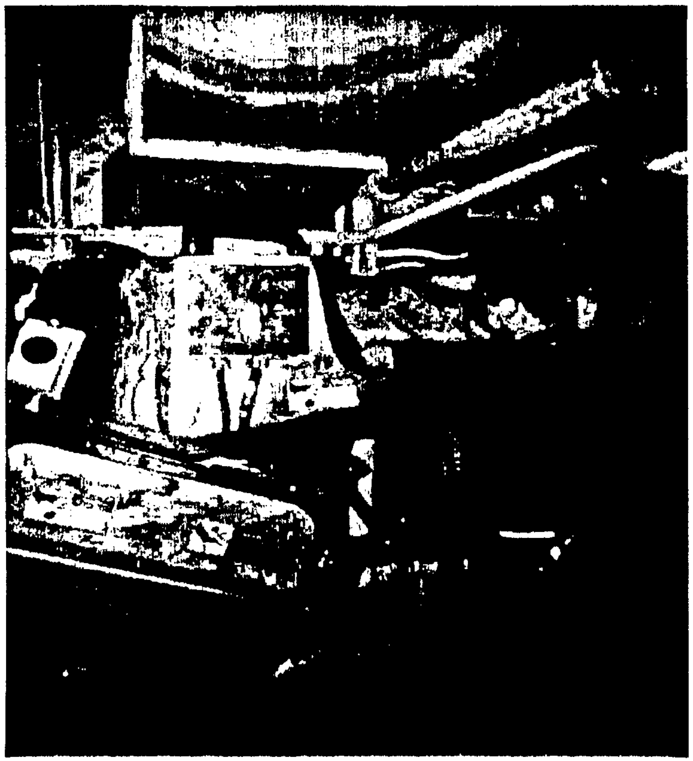
Small Pulper
(68.97"W x 25.5"D x 48.12"H)

Naval Sea Systems Command

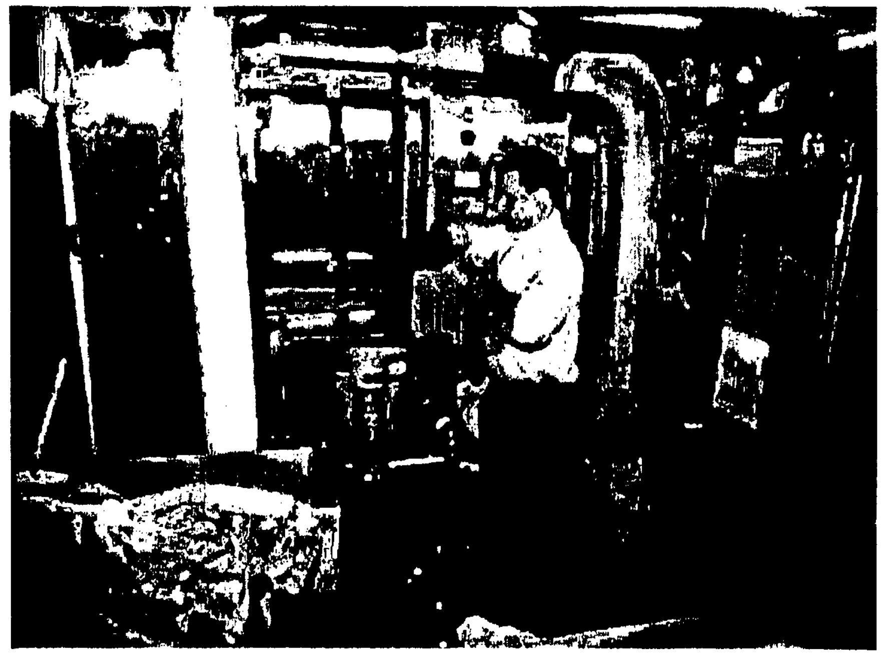
Shipboard Installations of Large and Small Pulpers

NSWC Naval Surface Warfare Center CARDEROCK DIVISION
Naval Sea Systems Command

Large Pulper



Small Pulper



Naval Sea Systems Command

Metal/Glass Shredder

NSWC
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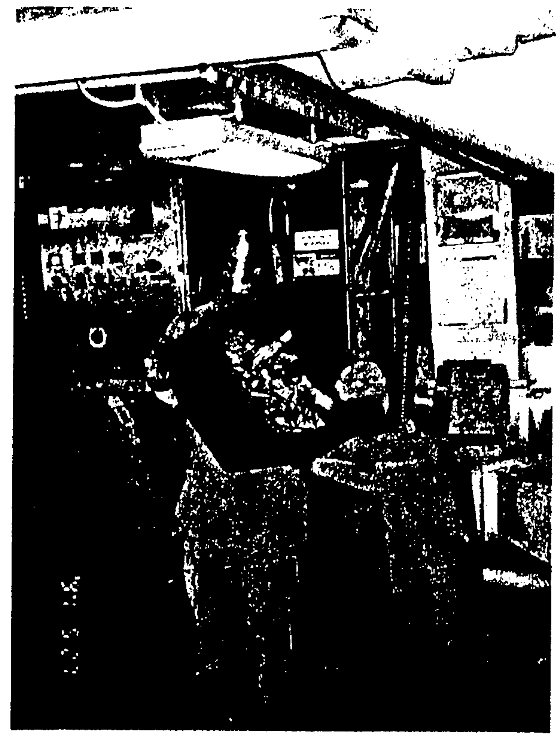
CARDEROCK DIVISION
Naval Sea Systems Command



The Metal/Glass Shredder processes all metal cans and glass bottles. This waste is then deposited into burlap bags, which will rapidly sink when disposed of at sea.

Naval Surface Warfare Center
CARDEROCK DIVISION
Naval Sea Systems Command

Pulper and MGS Lab Testing and Evaluation

- Process Optimization Tests
- Foreign Object Tests
- Component Life Cycle Tests
- Water Level Control Tests
- Sensor/control System Experiments
- Material Analysis
- Environmental Impact Assessment

Shipboard Test Installations

(Date as of 1 May 1998)

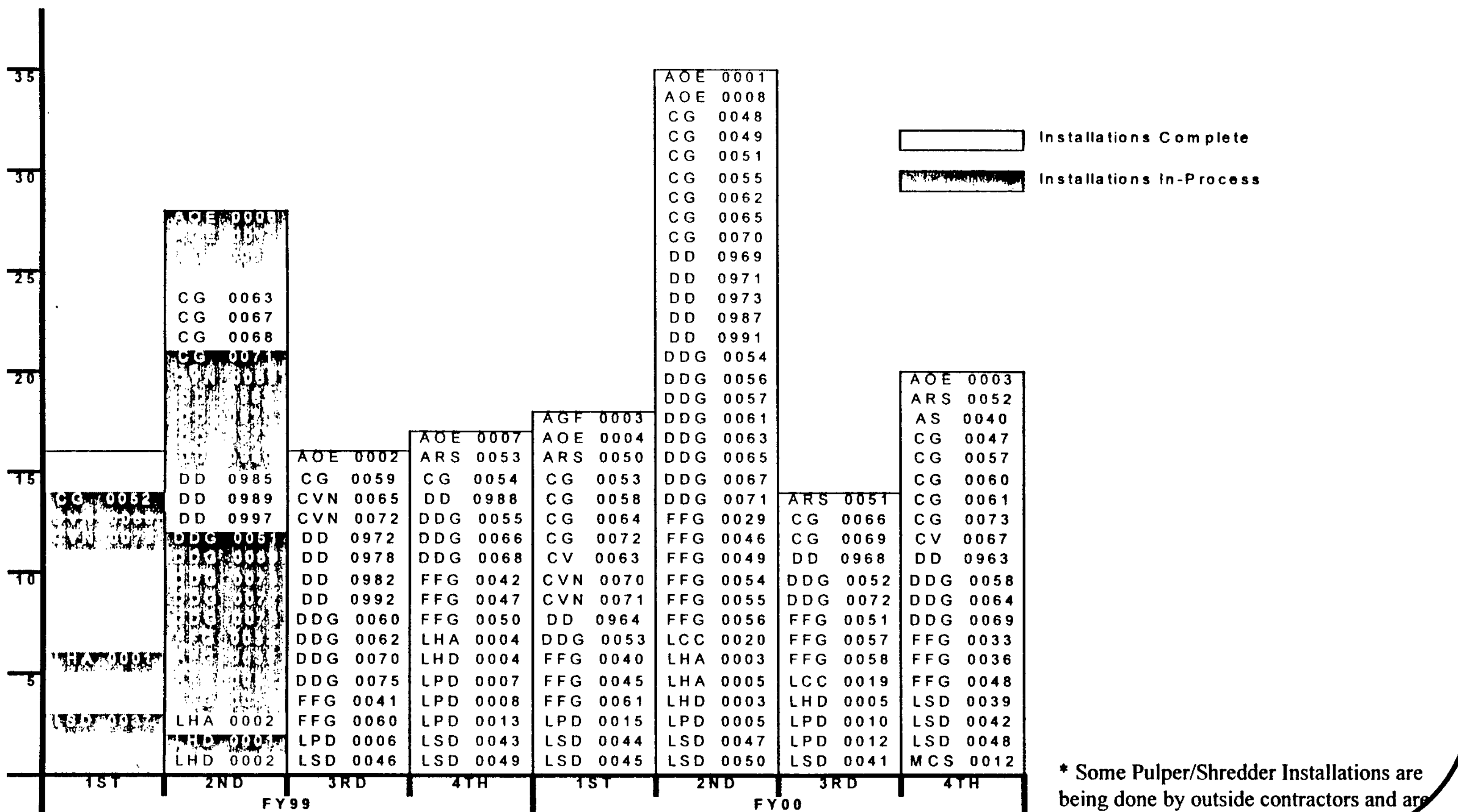
Ship	USS THEODORE ROOSEVELT (CVN 71)	USS GEORGE WASHINGTON (CVN 73)	USS WASP (LHD 1) Pre-Production Installation	USS CORONADO (AGF 11)
Date Installed	*modified* Mar-95; *Commercial Panel* - Nov 97	Jan-94	Aug-95; *removed 3/96 for CORONADO*	May-96
Deployments	Mar 95 - Sep 95 Nov 96 - May 97	May 94 - Nov 94 Jan 96 - Jun 96 Oct 97 - Apr 98	Aug 95 - Mar 96	
Hours of Operation	6,700	11,690	3,269	933
Weight Processed, lbs	1,250,000	2,571,800	648,818	186,600

The small pulper was successfully tested on the USS George Washington and on the USS Vandegrift. The MGS was tested on the USS George Washington.

Pulper And Shredder Major Milestones

- Contract Award - 25 November 1997✓
- First Unit Delivery - June 1998✓
- Initial Installation- August 1998✓
- Navy Compliance Date - December 2000

Pulper/Shredder Installation Schedule*



* Some Pulper/Shredder Installations are being done by outside contractors and are not shown on this schedule.

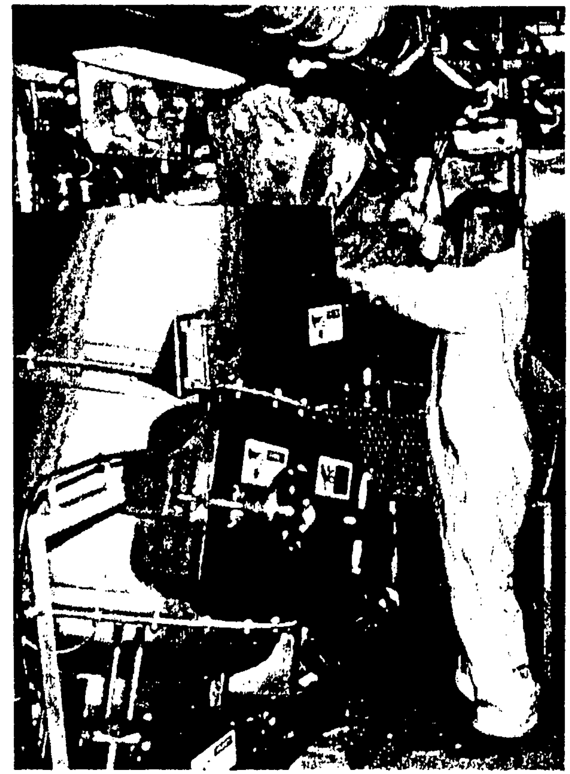
Naval Sea Systems Command

Shipboard Solid Waste Conference 21-23 April 1999

30

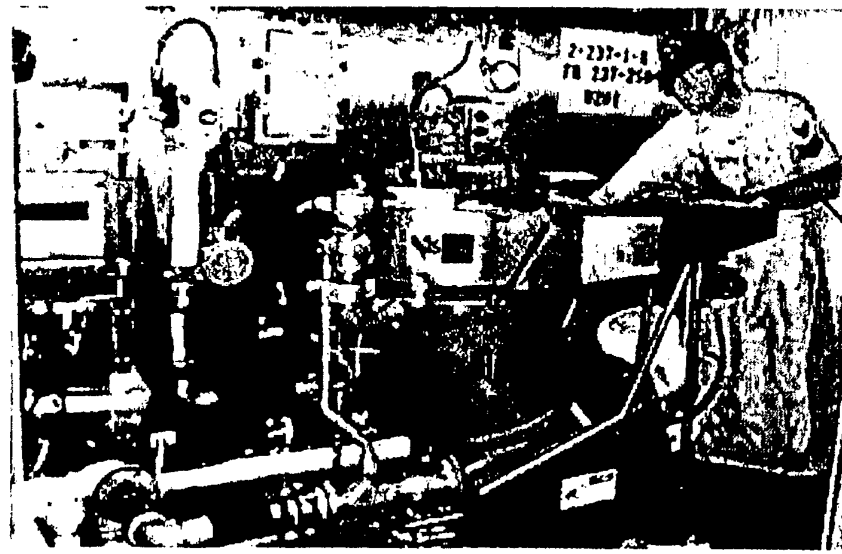
Large Pulper
Operational Requirements

- Processing Rate:
  - Paper and Cardboard: 500 lb/hr (227 kg/hr)
  - Food Waste: 1,000 lb/hr (454 kg/hr)
  - Mixed Waste: 680 lb/hr (304 kg/hr)
- Mean Time Between Critical Failure (MTBCF): > 500 hr
- Mean Time to Repair (MTTR): < 4 hr
- Mean Logistics Delay Time (MLDT): < 8 hr
- Maximum Down Time (Mmax): < 12 hr



Small Pulper
Operational Requirements

- Processing Rate:
  - Paper / Cardboard: 100 lb/hr (45 kg/hr)
  - Food Waste: 200 lb/hr (91 kg/hr)
  - Mixed Waste:140 lb/hr (64 kg/hr)
- Mean Time Between Critical Failure (MTBCF):
  > 500 hr
- Mean Time to Repair (MTTR):
  < 4 hr
- Mean Logistics Delay Time (MLDT):
  < 8 hr
- Maximum Down Time (Mmax):
  < 12 hr



Metal/Glass Shredder
Specifications

- Processing Rate: 250 lb/hr metal and glass
- Mean Time Between Critical Failure (MTBCF): $\geq$ 500 hr
- Mean Time to Repair (MTTR): $\leq$ 4 hr
- Mean Logistics Delay Time (MLDT): $\leq$ 8 hr
- Maximum Down Time (Mmax): $\leq$ 12 hr

LARGE PULPER SHIPBOARD INTERFACE REQUIREMENTS

NSWC Naval Surface Warfare Center CARDEROCK DIVISION
Naval Sea Systems Command

Requirement	Large Pulper
Electrical	440 Volts alternating current, 3 Phase, 60 Hertz, 50 Amperes
Seawater	180 gallons per minute (681 L/s) strained
Low Pressure Air	1.5 cubic feet per minute (0.71 L/s) at 80-125 pounds per square inch (552 – 862 kPa) for valve control
Equipment Drain	Required near pulper clean-out door and junkbox door
Foundations	Certified to Grade B Shock
Recommended Seawater Supply Line Size	2 inches (5.1 cm)
Recommended Discharge Line Size	4 inches (10.3 cm)

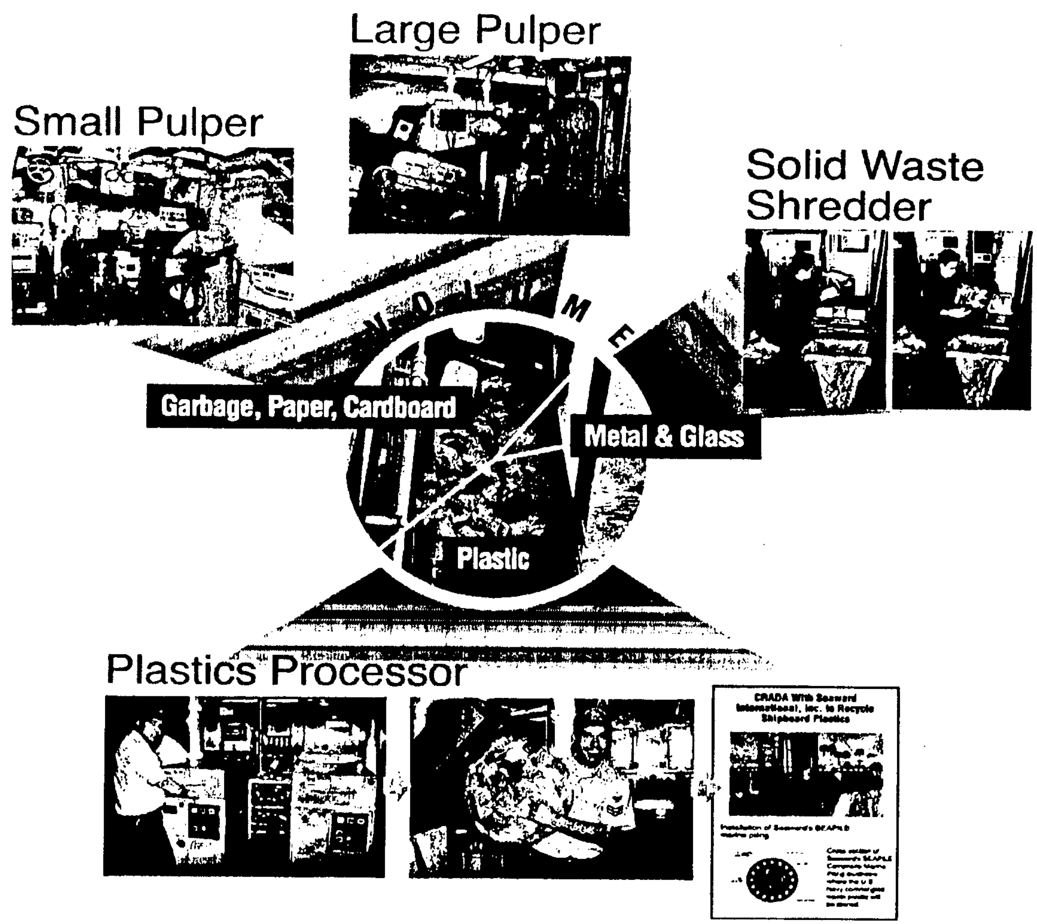
SMALL PULPER SHIPBOARD INTERFACE REQUIREMENTS

NSWC
Naval Surface Warfare Center
CARDEROCK DIVISION
Naval Sea Systems Command

Requirement	Small Pulper
Electrical	440 Volts alternating current, 3 Phase, 60 Hertz, 25 Amperes
Seawater	50 gallons per minute (189 L/s) strained
Low Pressure Air	1.0 cubic feet per minute (0.47 L/s) at 80-125 pounds per square inch (552 – 862 kPa) for valve control
Equipment Drain	Required near pulper clean-out door and junkbox door
Foundations	Certified to Grade B Shock
Recommended Seawater Supply Line Size	1.5 inches (3.8 cm)
Recommended Discharge Line Size	2.5 inches (6.6 cm)

U.S. Navy Solid Waste Management Strategy

Naval Sea Systems Command



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Lindau
Entsorgungstechnik GmbH

The Maritime environment

"Solid Waste Treatment Technologies for ships"

by Eule & Partners

21th – 23th April 1999
Crone Plaza Hotel
Antwerp Belgium

Dry Waste Management making use of Shredder, Glass – Crusher, Compactor and Chute Systems

Lindau Entsorgungstechnik GmbH
Postbox 13 54
D - 59203 Ahlen / Westf. , Germany
Fon: + 49 - 23 82 - 9 18 50 - 0
Fax: + 49 - 23 82 - 9 18 50 - 10

Mr. Uwe Wittkamp

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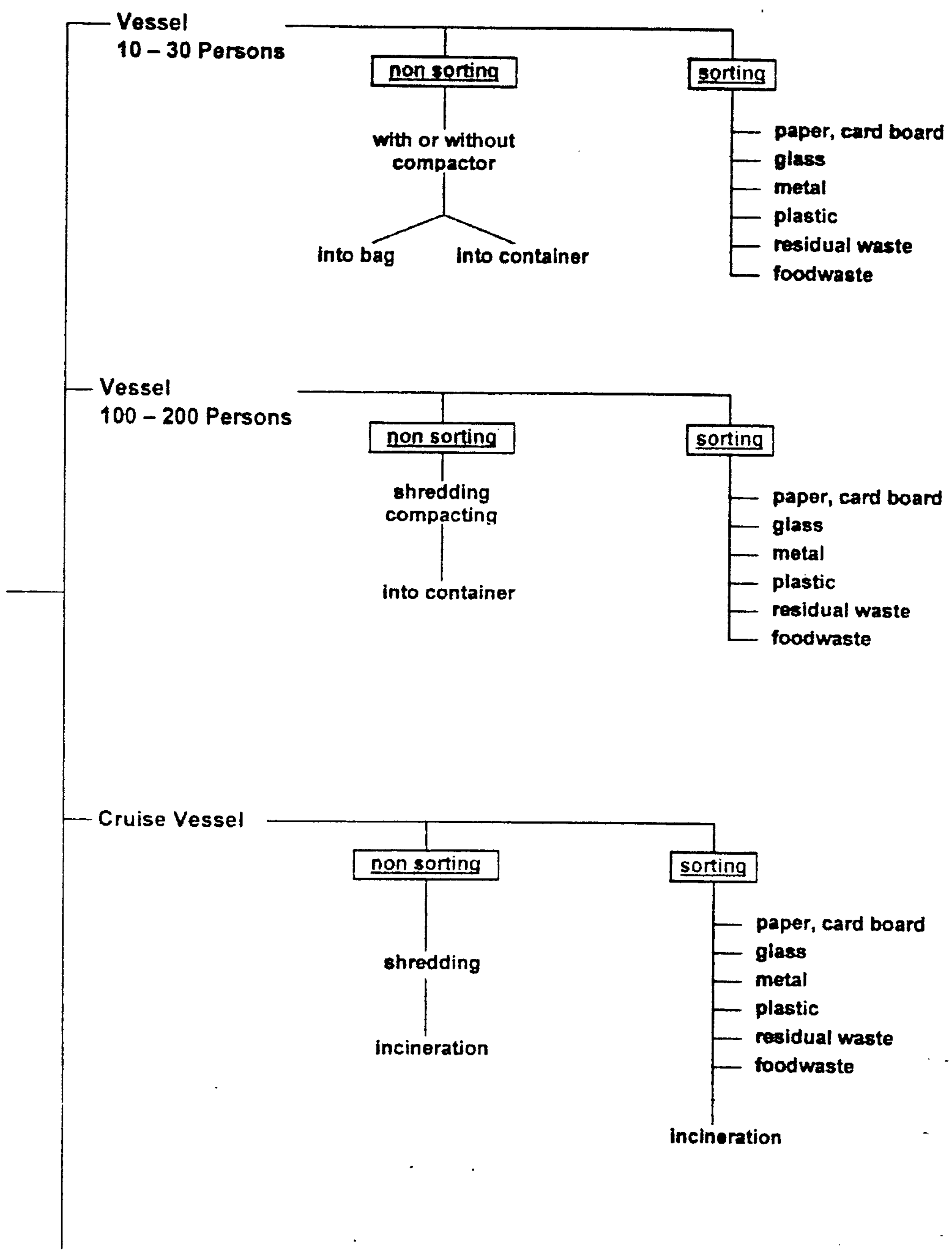
Lindau

Entsorgungstechnik GmbH



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sorting

glass

- Shredder
- Glass – Crusher LGC 40
- Vibration - Glass – Crusher VGC 80

metal

- Shredder
- Densifier LP 20

paper / cardboard

- Shredder
- Compactor

plastic

- Shredder
- Compactor

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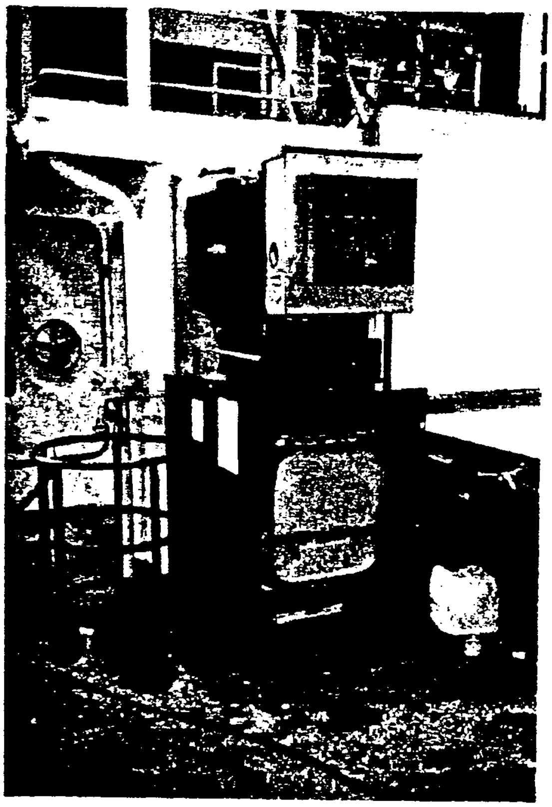
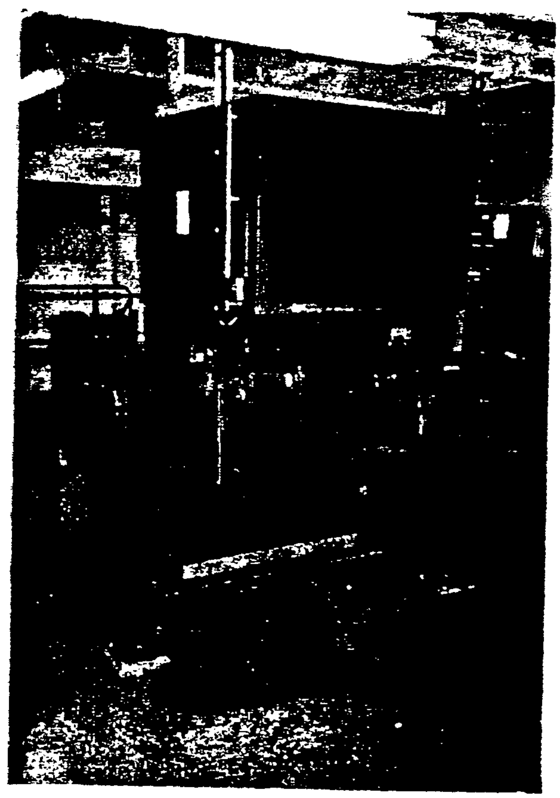
Lindau
Entsorgungstechnik GmbH

Shredder





4

Lindau
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Shredder

electrical supply: 4,5 - 45 kW (or even more)

Technical assembly:
- connection of electr. drive and shredder by:
  - gearbox, beltdrive, chaindrive, hydr. system
- 2 shredder shafts coupled (by tooth gear),
- shafts have little different rotation speed (hexagonal shafts, shafts with keys, involute geared shafts)
- shafts equipped with knifes, spacers and cleaning fingers

Important technical details:
- shafts diameter
- clearance knife to knife (0,05 – 0,1 mm)
- material and hardness of knifes

overload protection:
- current control
- rotation control
- flexible bearing of the electrical drive
- belt drive gearing
- overload clutch

- vibration damper to minimize structure born noise

safety devices:
- safety bars
- emergency off button
- rubber curtains
- safety switches

- automatic lubrication of the shaft bearing

Shreddable material:
- mixed garbage
- plastic
- paper, cardboard boxes
- wood
- glass
- tins

Processing result:
- shredding reduces volume (Volume reduction 3-10 : 1)
- shredding increase the surface (for better burning results in the incinerator)
- shredding to enable automatic transport of the waste in the silo and the conveyors

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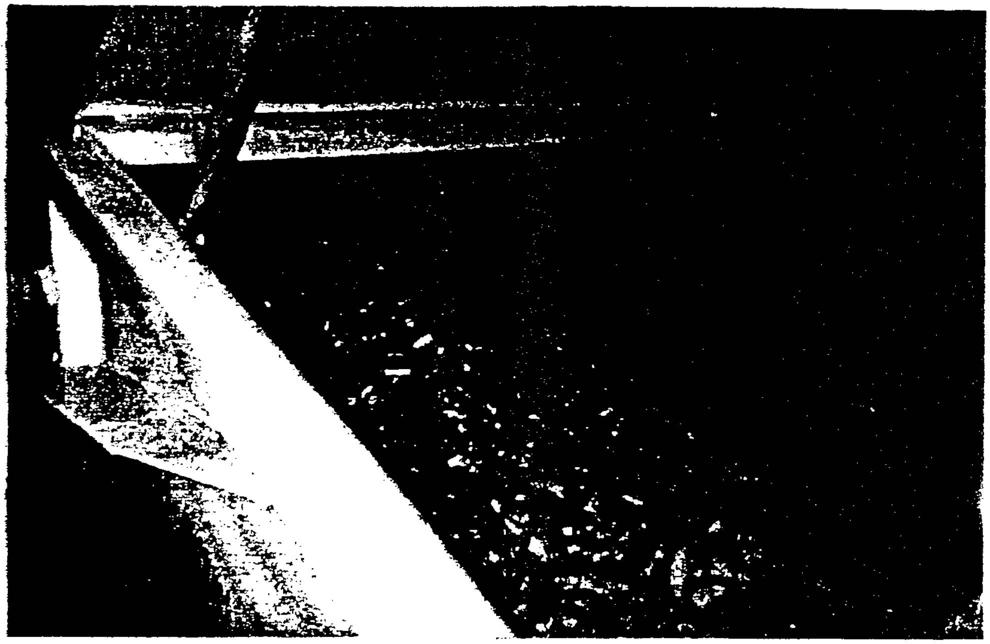

Mülltcontainer mit geshreddertem Material

Müllcontainer mit geshreddertem Material

6

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Glass

1 bottle (1 Liter volume)	-		0,4 – 1,0 kg	weight
100 bottles (each 1 Liter volume)	-	about	150 – 200 Liter	space
100 bottles (each 1 Liter volume)	-	about	40 – 100 kg	weight

specific weight of melted glass about 2,5 kg/ltr

Volume reduction after shredding / crushing

100 bottes (each 1 Liter volume) - about 170 Liter space

reduced to 25 – 30 Liter space

Volume reduction about 5 – 6 to 1

specific weight of crushed glass about 1,6 – 2,0 kg/ltr

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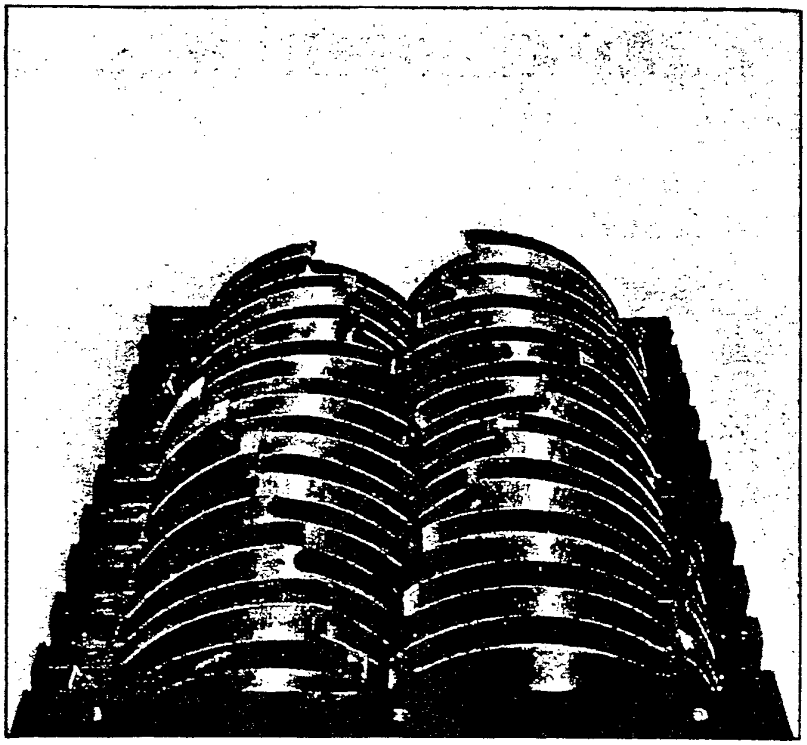
Glass

shredding / crushing machines

Shredder



electrical supply:	4,5 – 15 kW
Knifes:	3 Hook Typ, thickness 15 – 30 mm
Important:	Hooks have to be long enough to catch the bottles good protection of bearings, close casing Lubrication of bearings
Particle Size:	0 – 50 mm

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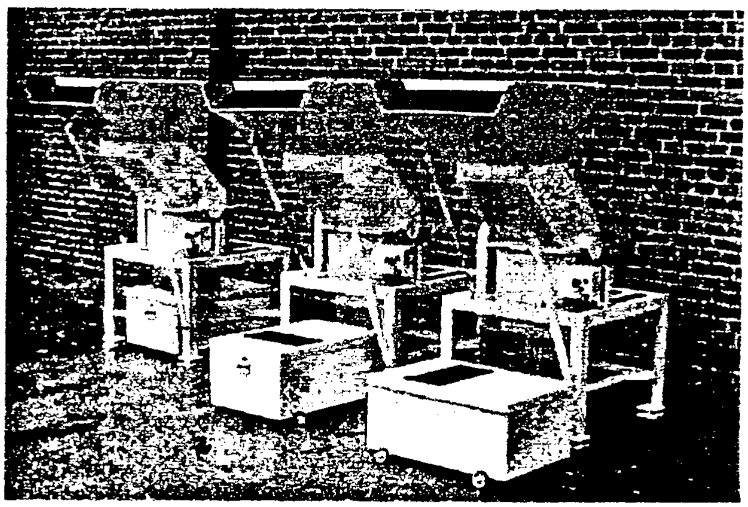
Glass

shredding / crushing machines

Glass – Crusher GC 40



electrical supply:	2 – 2,5 kW
Knifes / Blades:	8 blades assembled on a fast rotating rotor 2 stationary blades
housing:	inside coated with anti wear rubber outside coated with sound absorbing material machine based on vibration dampers
Trough put:	about 1500 – 2000 bottles per hour
Crushing result:	particle size about 0 – 30 mm
Collection:	trolley size about 100 liter

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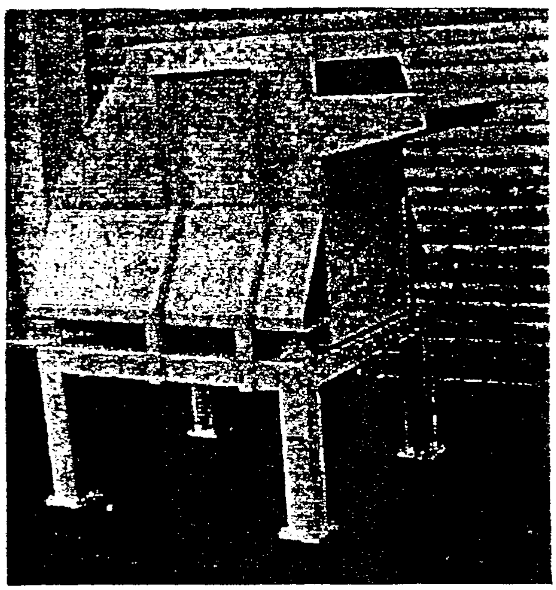
Glass

shredding / crushing machines

Vibration - Glass - Crusher VGC 80



electrical supply:	1,5 – 2,0 kW
Plates:	1 stationary plate 1 vibrating plate based on vibration levels driven by an excentric motor
Plate Typ:	special hardened steel (manganese steel)
Through put:	about 2000 - 3000 bottles per hour
Crushing result:	particle size about 0 – 60 mm
advantage:	only 4 wear parts - 2 crushing plates - 2 side walls
collection:	special trolley volume about 100 – 250 liter device for filling into bag or cardboard box available

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Metal

1	can	(0,33 Liter volume)	-	about	30 gr.	weight
100	cans	(each 0,33 Liter volume)	-	about	3 kg	weight
100	cans	(each 0,33 Liter volume)	-	about	55 - 60 Liter	volume (heaped up)
850	cans	(each 0,33 Liter volume)	-	about	450 - 510 Liter	volume (heaped up)

Volume reduction after compaction

for example Densifier LP 20

850 cans (each 0,33 Liter volume) - 1 compacted package 25 kg

850 cans (each 0,33 Liter volume) - 1 compacted package 20 Liter volume

Volume reduction by Densifier LP 20 about 20:1

(Volume reduction of cans (5 Liter volume each) by Densifier LP 20 about 24:1)

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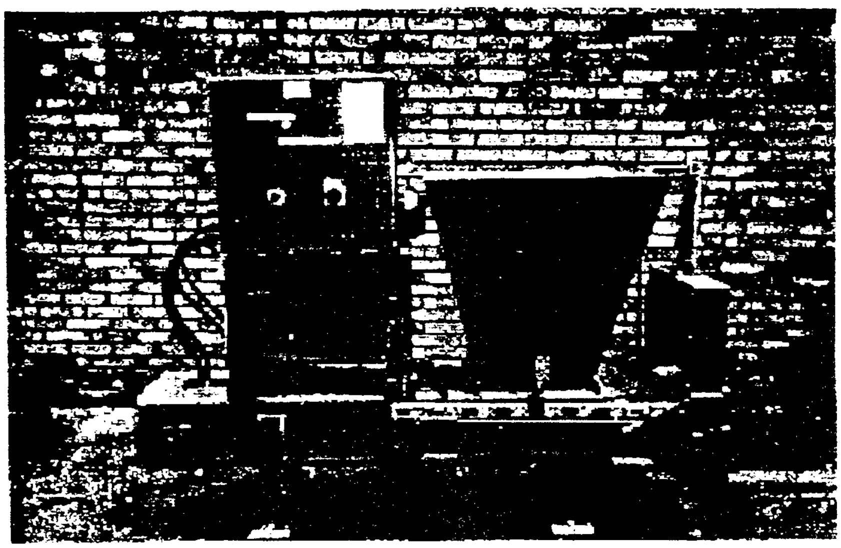
Metal

compacting machines

Densifier LP 20



electrical supply:	4,5 - 9 kW
	Electro – hydraulic system horizontal operating ramp compacting the material against a vertical plate
Package size:	300 x 400 x 250 mm
Package weight:	20 – 30 kg

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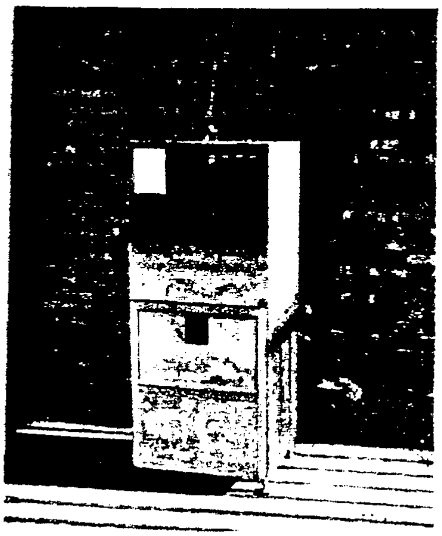
Compacting machines (small Type)

P 75



electrical supply:	1,0 kW
	Electro – hydraulic system vertical operating cylinder compacting the material into a metal box
compactable material:	mixed waste, plastic, cardboard, tins
compaction:	Rate 30 : 1 / 4 : 1 depends on material
infeed opening:	b = 550 mm h = 350 mm
Package size:	B = 550 W = 450 H = 300 – 400 mm
	output into a bag posibble, to collect liquids and to close the bag to avoid odour

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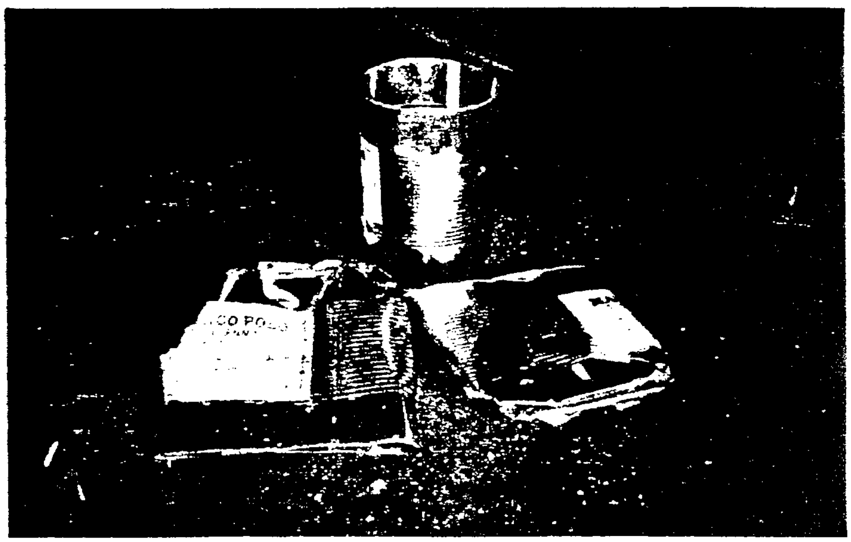
Compaction result with small Compactor P75



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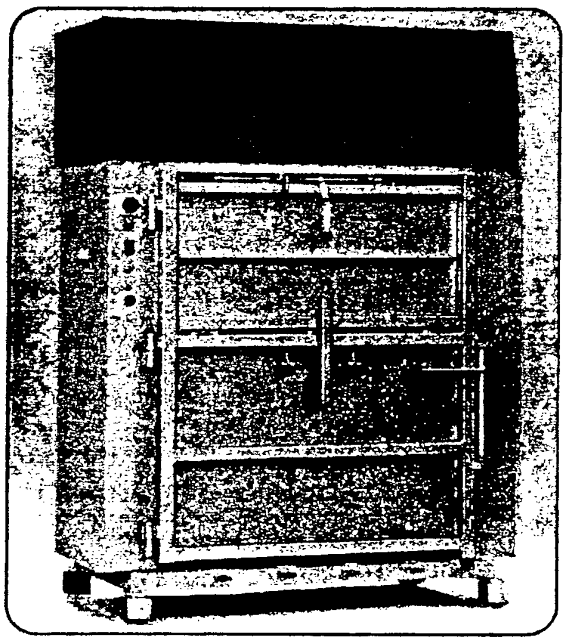
Compacting machine (big Type)

BP 80



electrical supply:	4 - 5 kW
operation:	- hydraulic system with cylinder - spindle system
compactable material:	mixed waste, plastic, cardboard, tins
compaction:	Rate 30 : 1 / 4 : 1 depends on material
infeed opening:	b = 780 mm h = 500 mm
Package size:	B = 1100 W = 650 H = 700 - 1000 mm
Package weight:	100 – 200 kg
	automatic output on a wooden pallet

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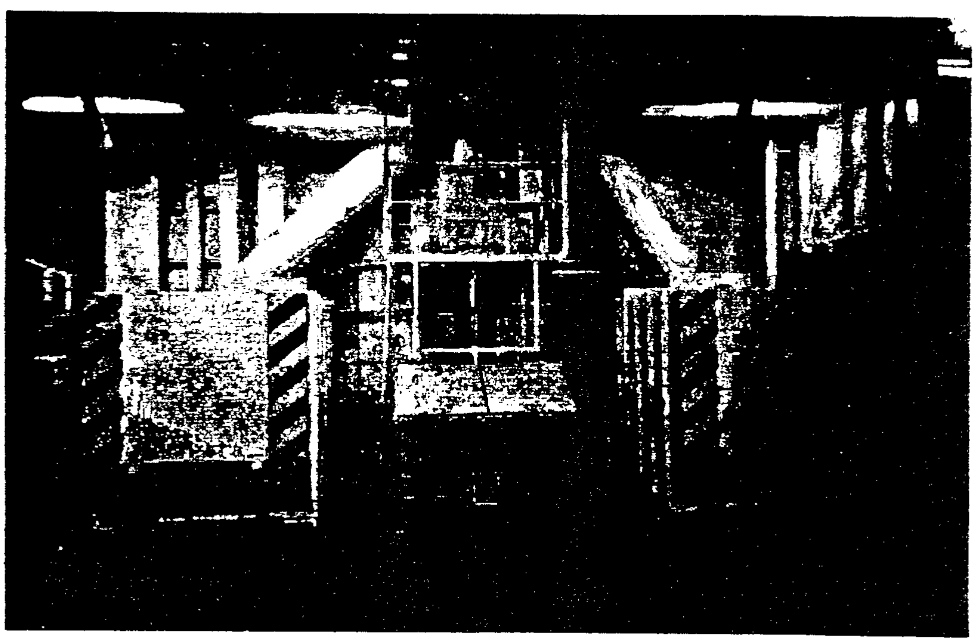
S3P3-PICT16.JPG

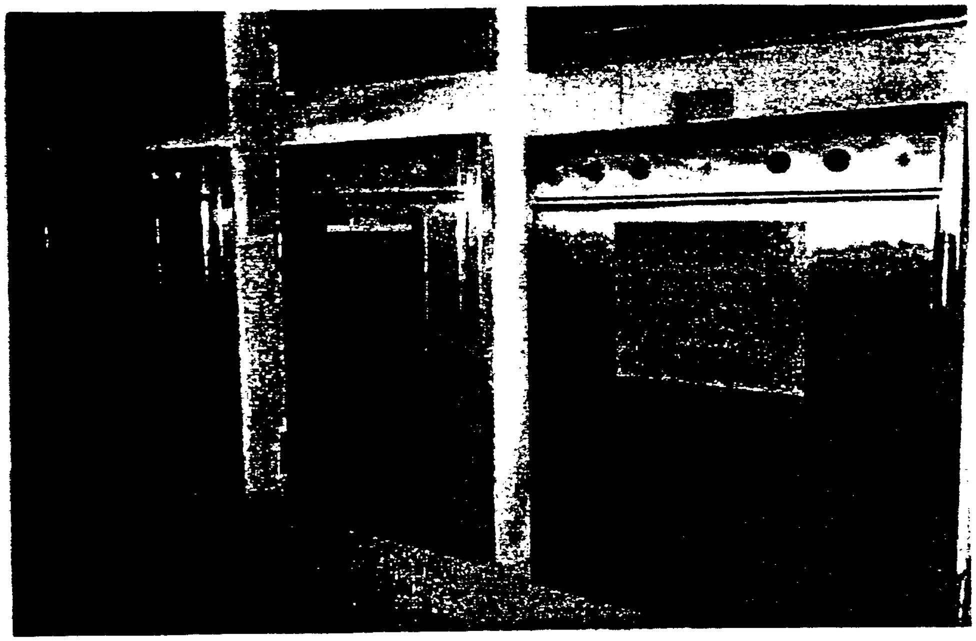
"Mecklenburg - Vorpommern"
D F O, Rostock
Schichau Seebeck Werft, Bremerhaven
Mai 1997

D F O
Hansa - Line
Rostock

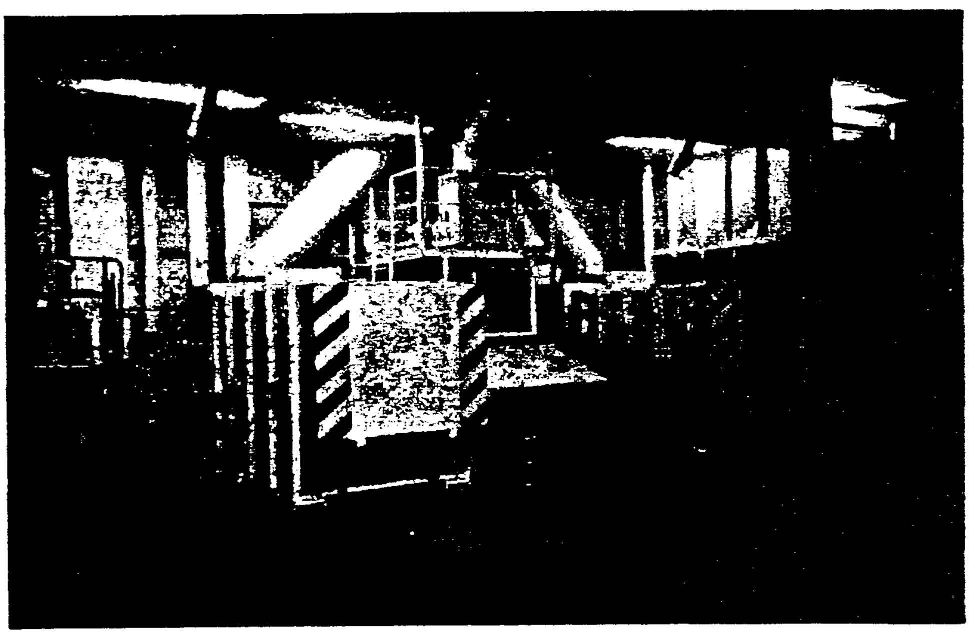


Trockenmüllentsorgung, Mülltrennung
Dosen (Schneckenpresse), Glas (Shredder / Container), Restmüll (Schneckenpresse)
Autodeck

S3P3-PICT17.JPG



Einwurfstationen im "Galley" - Bereich
Dosen - Glas - Restmüll



Trockenmüllentsorgung auf dem Autodeck

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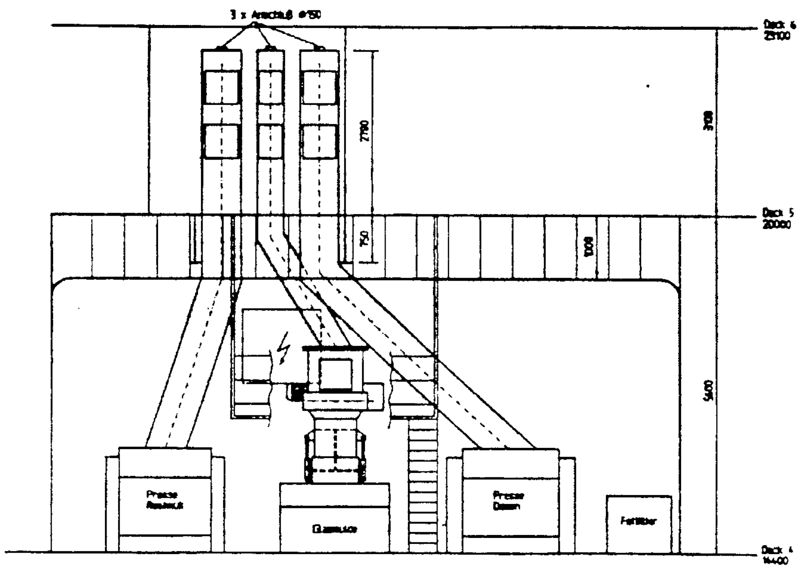
Chute System

Schnitt A - A



3 Chutes for	- tins (screw compactor and container) - glass (shredder and container) - mixed garbage (screw compactor and container)
Chute:	Diameter 300 – 700 mm Material: stainless steel material thickness: 2 or 5 mm - outside coating to reduce structure born noise - bearings with vibration dampers on each deck
Feeding door:	on each deck possible fire tested doors, self closing electrical interlock (only one door open at one time)
Fire valve:	at car deck possible (pneumatic operating, according to specification)
Integration:	of shredders, compactors possible
Connection to container:	flexible chute or telescope chute (pneumatic operated)
Collection of waste:	closed container 1,5 – 6 m^3, water tight

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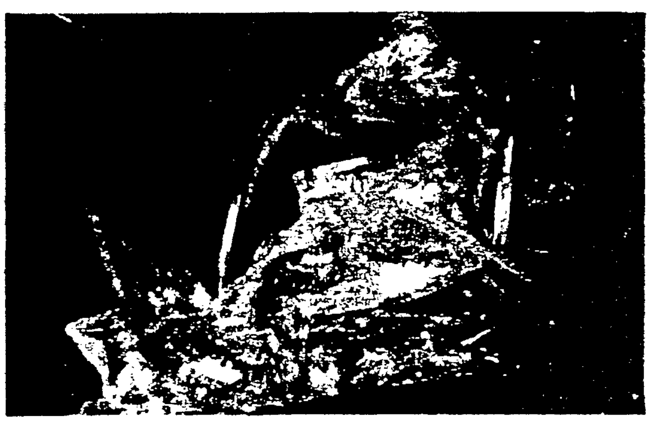
screw compactors:

- very solid compactor typ (able to crush and compact complete wooden pallets)
- electrical supply 11 – 15 kW
- screw diameter 800 / 500 mm
- water tight housing up to 300 mm
- direct tight connection to the container (container itself watertight up to 200 mm) (do not use compactor with compaction ramp)
- container volume 8 – 20 m^3 (special container which are watertight to 700 mm are available)

Special equipment:

- Fire horse connection at the container
- Lifting device at the container
- Additional feeding door for garbage at the snail compactor (to feed from the car deck)
- automatic hydraulic coupling device
- screw compactor (stainless steel type) for handling of food waste



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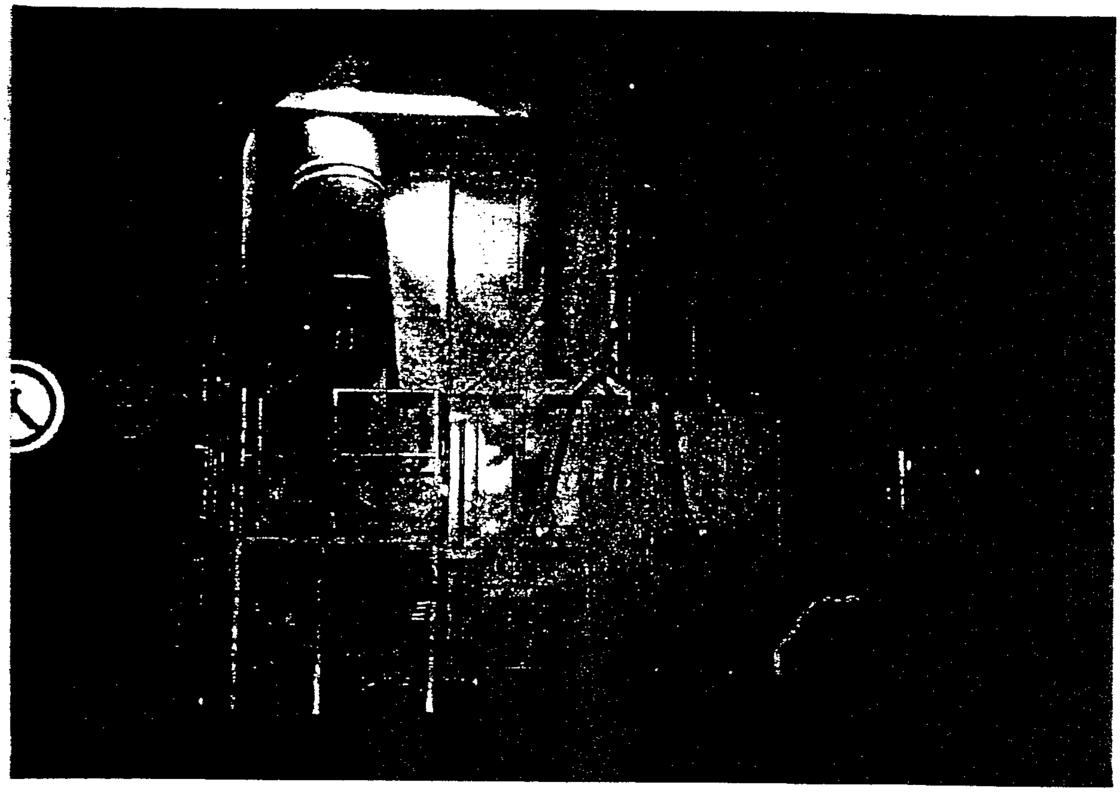
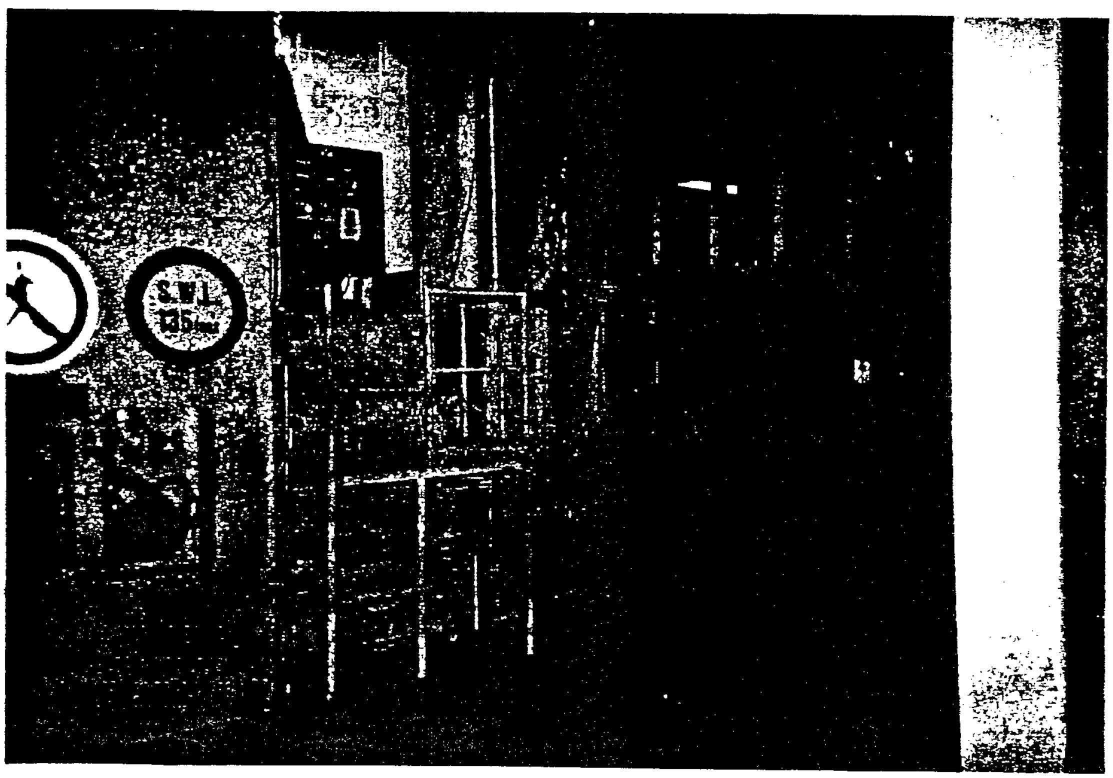


Waste Compactor Deck 3



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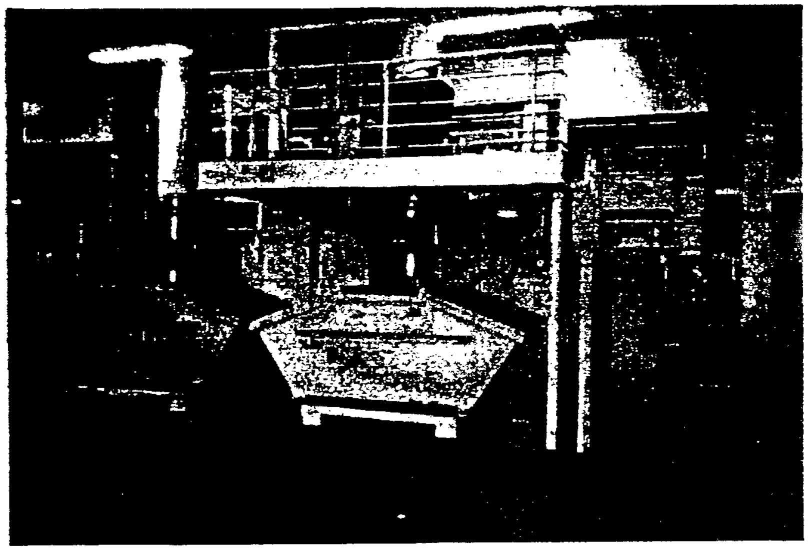
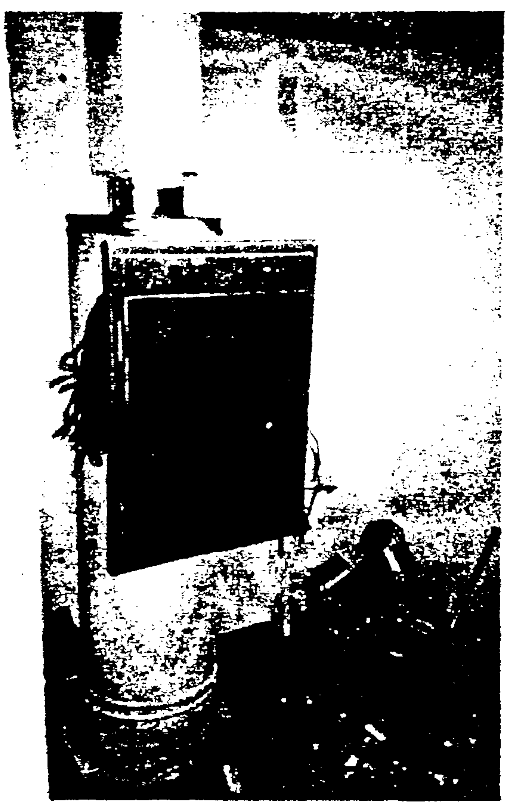
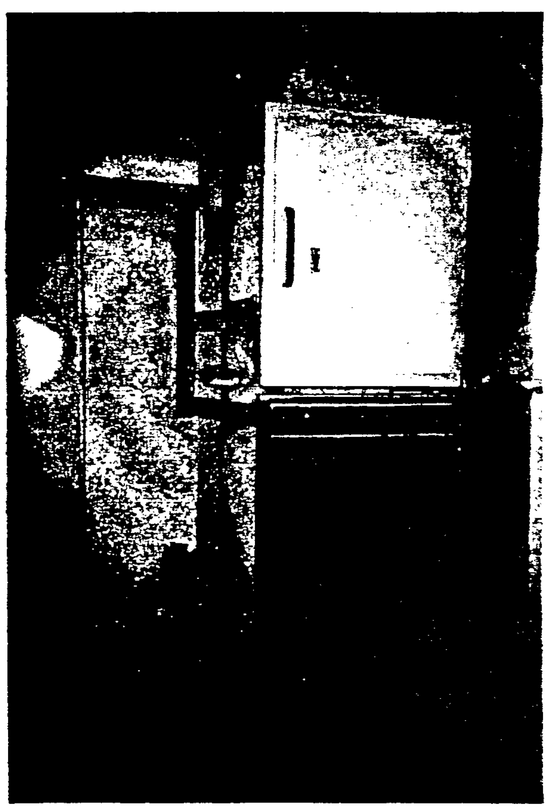
Abwurfanlage für Glas (links) mit Teleskopabfüllrohr
Abwurfanlage für Müll (rechts) mit Shredder und Teleskopabfüllrohr



Glasabwurf



Müllabwurf



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THE HOBART PULPER SYSTEM

THE MOST RELIABLE AND EXPERIENCED FOOD AND WET WASTE SYSTEM

By Wolfgang Zillgith
HOBART PULPER System, GE

After many years of experiencing waste systems onboard ships and cruise vessels, it is obvious that the **HOBART Pulper System** is absolutely suitable to process, transport and discharge food and wet waste as well as solid waste in different areas on ships such as main and crew galleys, meat and vegetable preparation areas.

Since 1968, when **HOBART** introduced their pulper systems into the US markets, followed by introduction in Europe, new ways have been opened to manage the waste problems especially for food and wet waste. At those days a big volume of disposable dishes, cardboard, foils etc. needed to be discharged or atleast to be reduced in volume.

The answer was the **HOBART ECOLO Pulper System**, which was developed to a very suitable waste management system. The first Pulper System was installed in 1983 on the MS Europa, consisting of 3 pulpers connected to one central waterpress. To save water and energy this system was designed as a recirculating unit with slurry and return lines. This modular system was the successor of the compact units, at which the waterpress was directly connected to the pulper unit.

THE SYSTEMS

ECOLO COMPACT UNIT

This unit is a combination of pulper and waterpress. The pulper consists of a pulper drum filled with water. At the bottom is a high speed rotating cutting unit to cat the waste which is flushed by an integrated trough into the pulper drum. The high rotating speed is creating a vortex, which brings the waste directly to

the knives to be cut in fingernail size, which is the optimal size for further processing.

These particles now can pass a screen and will be flushed into the waterpress unit. The waterpress consists of a screen cylinder, in which a rotating worm will transport out of the water, separating the waste from the processing water. The water can penetrate the screen by gravity. The process will be supported by a compressing device at the upper end of the worm. The de-watered waste falls through a discharge chute into a waste bin, to be stored, burned or to give ashore.

The pressed out water will flow back into the pulper drum, so just a few volume of water will be used. Integrated safety devices, such as cutlery catching magnets and/ or sinks as well as an inside collecting box take care, that no damages can be happen when misusing the system.

ECOLO MODULAR SYSTEMS

In the beginning these systems have been installed on land, before it was used onboard ships. As already said, the first system was installed in 1986, today more than 70 cruise vessels and ferries are equipped with pulper systems. The biggest system at all was installed at the P&O "Grand Princess" in 1998, where 20 pulpers and 5 waterpresses are in operation. More than 1 km of piping was necessary to connect the pulpers to the waterpresses. All units are part of an entire Waste Management System: The de-central waste discharge, the centralised waterpresses giving the conditioned waste to a food waste homogenising tank, from where the waste is injected into incinerators, reduced in volume to a minimum of ash, which is also automatically discharged.

The biggest benefit for the users is the fully automatic treatment and transportation from the galleys to the central processing unit.

This system is absolutely reliable and also forgiving misuse, if metallic items like cutlery etc. will be given into the pulpers by accident, needless to say that this will happen from time to time.

CAPACITIES

Disposers	75 to 250 kg/hour
Pulpers (compact and modular)	350 to 600 kg/hour
Waterpresses	750 to 4.800 kg/hour

One big waterpress can handle 8 to 10 pulpers at the same time.

WATER CONSUMPTION

Disposers	80 to 100 Litres/ hour
Pulpers (compact and modular)	100 to 150 Litres/ hour
Waterpresses	50 to 70 Litres/ hour

WASTE TO BE PROCESSED

- Food and Wet Waste
- Bones
- Vegetables
- Paper, paper napkins
- Cardboard
- Disposable dishes
- Plastic

THE PULPERS

- Especially designed for onshore and offshore applications
- Perfect integration in galley design
- Feeding troughs built in galley tables
- Integrated metal trap in trough consisting of sink and magnet
- Suitable for most of waste used on board
- Compact pulper design with table top, frame and housing in stainless steel
- Large pulper lid with safety switch
- Easy access for cleaning and maintenance

- Cutting device with 3 stationary and 2 rotating knives
- Double sided knives for longer lifetime
- Knives easy to replace, easy to sharpen
- Complete dismantable cutting unit including motor and mechanical seal for easy servicing
- Quick release plug for electric power supply line to pulper motor
- Inside located metal catch box, easy to remove to catch cutlery, bottle caps, glass and china ware, etc.
- Perfect safety for cutting knives
- Misuse allowed to a certain extent
- Stainless steel slurry pump, easy to service
- Safety overflow to drain
- Automatic water level control system by siphon device for constant pulper performance
    - No water loss by uncontrolled refilling of water
    - No level switches necessary
- 3/2 Way motor valve solution for return water distribution
    - Immediate "Ready for Operation" of pulpers due to continuous water recirculation
    - Continuous water flow in the pipework avoids blockage of residues
    - Individual cleaning of pulpers independent of pre-set cleaning cycle time of the entire pulper system
- Vibration pads with stainless steel ground plate to avoid vibrations and noise
- Fully enhoused unit with noise reduction device
- Easy to operate: Just "Start-Stop"-Button and pilot lights
- Completely controlled from central control box

THE BONECRUSHER UNIT

- Space saving compact unit with bone crusher and pulper
- Especially designed for offshore applications
    - For rare and cooked bones up to a length of 150 to 200 mm

    - Sea shells, fish skins
    - Capacity approximately 300 kg/hr
    - Easy cleanability of shredder unit
- Perfect integration in meat and vegetable preparation
- Bone shredder installed directly above the pulper drum
- Free-fall of shredded waste into pulper for fine pulping
- Easy access to feed bones via feeding chute
    - Security lid with safety switch
    - Comfortable loading height
- Charges of 8 to 10 kg
- Strong 7,5 kW shredder motor
- Complete shredder unit movable on rollers for easy access to pulper drum
- Integrated feeding trough for vegetable, parallel use possible
- Integrated metal trap inside pulper drum
- Compact pulper design with table top, frame and housing in stainless steel
- Easy access for cleaning and maintenance
- Cutting device with 3 stationary and 2 rotating knives
- Double sided knives for longer lifetime
- Knives easy to replace, easy to sharpen
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- Vibration pads with stainless steel ground plate to avoid vibrations and noise
- Fully enhoused unit with noise reduction device
- Easy to operate: Just "Start-Stop"-Button and pilot lights
- Completely controlled from central control box

THE BOOSTER PUMPS

- To ensure the correct pressure and water flow in the entire system
- Stainless steel pump, protection class IP 56
- Vibration pads with ground plate made of stainless steel to avoid any influence to ship structure
- Rubber compensators for slurry and return line
- Control box connected central PLC via bus line
- Integrated in optional visualisation system

THE PIPEWORK

- Especially designed for long distances onboard vessels
- Inside diameter calculated to required capacity, depending of amount of pulpers in use
- Totally made of stainless steel
- Ellbows 3-D or 5-D to avoid any blockage
- Self-cleaning by smooth inside surface
- Stainless steel flanges at pulpers and waterpresses

THE WATERPRESSES

- Especially designed for offshore applications
- For up to 10 pulpers at the same time
- Capacity up to 2.700 kg/hr
- Unit consisting of frame , tank, housing pressing device, all made of stainless steel
- With or without reservoir tank
- Totally panelled with stainless steel
- High quality Polyethylene worm with nylon screw brush, easy to clean and to maintain
    - To ensure perfect water penetration
    - Dismantling without any tools
    - Easy access by large inspection doors
- Adjustable pressing device to adapt to further processing
- Rinse system for worm and strainer system
- Discharge chute to food waste processing tank
- Bag filling also possible by turnable discharge chute
- Various stainless steel return pumps
    - Easy access by large inspection doors
    - Easy dismantling supported by sliding device
- Vibration pads to avoid noise and vibration to ship structure
- Rubber compensators in slurry and return line to avoid vibrations
- PLC Control system with bus lines to pulpers, bonecrusher unit and booster pumps connected to ship control system
- Automatic central cleaning program
- Cabling in MGSGO quality, halogen free
- Dosing equipment for detergent and/ or disinfecting
- Visualisation system as an option:
    - Status information
    - Fault and diagnostic information

- Alarm list for external or internal printer
- Operating and service instructions
- Trouble shooting
- Wiring diagrams
- Spare part list

• The Maritime Environment •

"Solid Waste Treatment Technologies for Ships"

Session 4

System Engineering for Solid Waste Treatment on Ships

Session Chairwoman: Mrs. Denise Oakley, AEA Technology, UK

Session 4– System Engineering for Waste Treatment on Ships

Session Chairwoman, Mrs. Denise Oakley, AEA Technology, UK

Mrs. Denise Oakley studied micro-biology at Warwick University, UK, and environmental engineering at Birmingham University, UK.

She has been with AEA Technology since 1987, gradually moving from technical and engineering work into project management and business development.

Denise has been active in waste management studies for the European Space Agency and the UK Navy.

AEA Technology provided key technical and management information to NATO NIAG Pre-feasibility Study on Environmentally Sound Ship. Denise is currently Project Manager of the UK Feasibility Study in to Future Waste Stream Solutions for the UK Navy.

Mrs. Oakley will now take the chair for session 4 and present her paper on

Integrated Waste Management Systems for Future Ships

Paper 2: Olle Lundberg, USON Marine, SE

I like to introduce Mr. Olle Lundberg from USON Marine, SE.

After he achieved a degree as Master of Science, Chemical Engineering, at the Royal Institue of Technology, Stockholm joined USON Marine an is now the Area Sales Manager in the company owned by Lars Uson Lundberg, also attending this conference.

Olle Lundberg will now present his paper on

Evolution of Waste Management

Paper 3: Jochen Deerberg, DEERBERG-SYSTEMS, GE

I think there is no particular need to introduce Mr. Jochen Deerberg since he was introduced yesterday.

Mr. Deerberg will now present his paper on

Multi Purpose Waste Management System

INTEGRATED WASTE MANAGEMENT SYSTEMS FOR FUTURE SHIP DESIGN

Denise L. Oakley[1]
AEA Technology Environment, E4 Culham,
Abingdon, Oxfordshire, OX14 3DB

ABSTRACT

The introduction of increasingly stringent environmental regulations, increasing cost for shore-based disposal and a need to safeguard public image has driven many of the NATO Navies to begin the process of implementing environmentally sound future ship design. This will involve the inclusion of environmental considerations at all stages of the ship design, and will ultimately include all aspects of the ship, such as paints, anti-foulants, end of life disposal of equipment, sub-systems and even the hull, not just waste management systems.

Environmentally sound future ship design also needs to consider the impact of source reduction and waste minimisation, and recognise that these will be maximised in most future applications. This will result in smaller quantities of waste for onboard management and processing. The handling, storage and shore-based disposal of unprocessed wastes and the residues from treatment processes are also important considerations within any overall integrated waste management strategy.

For solid wastes, there are a variety of management options. These include: the storage of unprocessed wastes; shredding, compaction and storage of compacted materials; sterilisation and storage; oxidative (with air) destruction or pyrolysis (in a reduced oxygen atmosphere). The selection of suitable processes will be based on the types of waste requiring treatment, the quantities and generation rate, the availability of storage capacity for any unprocessed / compacted wastes and / or residues, and the date by which equipment needs to be available.

The recently completed UK Feasibility Study into Integrated Wastestream Solutions for Environmentally Sound Future Warship Design has evaluated a wide range of potential waste management / treatment options. For the constraints and requirements specified for the UK Future Surface Combatant, a number of potentially feasible integrated waste management systems have been identified. An overview of the approach to this study, the methodologies developed for selection and comparison of waste treatment systems and the key findings will be presented in this paper.

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E mail: denise.oakley@aeat.co.uk

Integrated Waste Management Systems for Future Ship Design

Denise L. Oakley,
AEA Technology

Solid Waste Treatment Technologies for Ships

21st - 23rd April 1999

Contents of presentation

- Drivers for environmentally sound future ship design
- Waste minimisation
- Development and selection of Integrated Waste Management Systems
- Shore side considerations
- Development needs

Overall Objective

The Environmentally Sound Ship

- Waste minimisation through supply chain management and crew awareness training
- Destruction of all wastes onboard or treatment producing benign emissions (solids, liquids and gases) (i.e. no adverse impact)
- Any residues held safely onboard
- Environmentally sound shore based treatment / disposal / recycle / reuse

Worldwide operation with no constraint imposed by International, National or local regulations

Current / Future Drivers

- limits on acceptable overboard discharges
  - legislation driven
  - signature driven
- Increased costs of shore based disposal
- Avoidance of non-compliance (fees / fines)
- Maintenance of operational freedom worldwide
- Safeguard public image

Boundary Constraints

- Future legislation (2007 onwards)
- Ship characteristics
- Mission profiles and operational requirements
- Impact of propulsion systems
- Waste generation rates and composition *(including predicted source reduction and waste minimisation)*

Wastes (1) - Source Reduction & Minimisation

Predictions for effect on waste generation:

Plastics	- 25%	Clinical Waste	0%
Paper & Card	- 5%	Blackwater (Vacuum)	0%
Food Waste	- 5%	Greywater	- 20%
Metal Waste	- 5%	Oily Water	- 20% (but $2m^3$/day peak agreed)
Glass	0%	Waste Oil	- 20%
Trash	0%	VOC's (Refuelling)	- 45%
Sanitary waste	0%		

Technology Overview

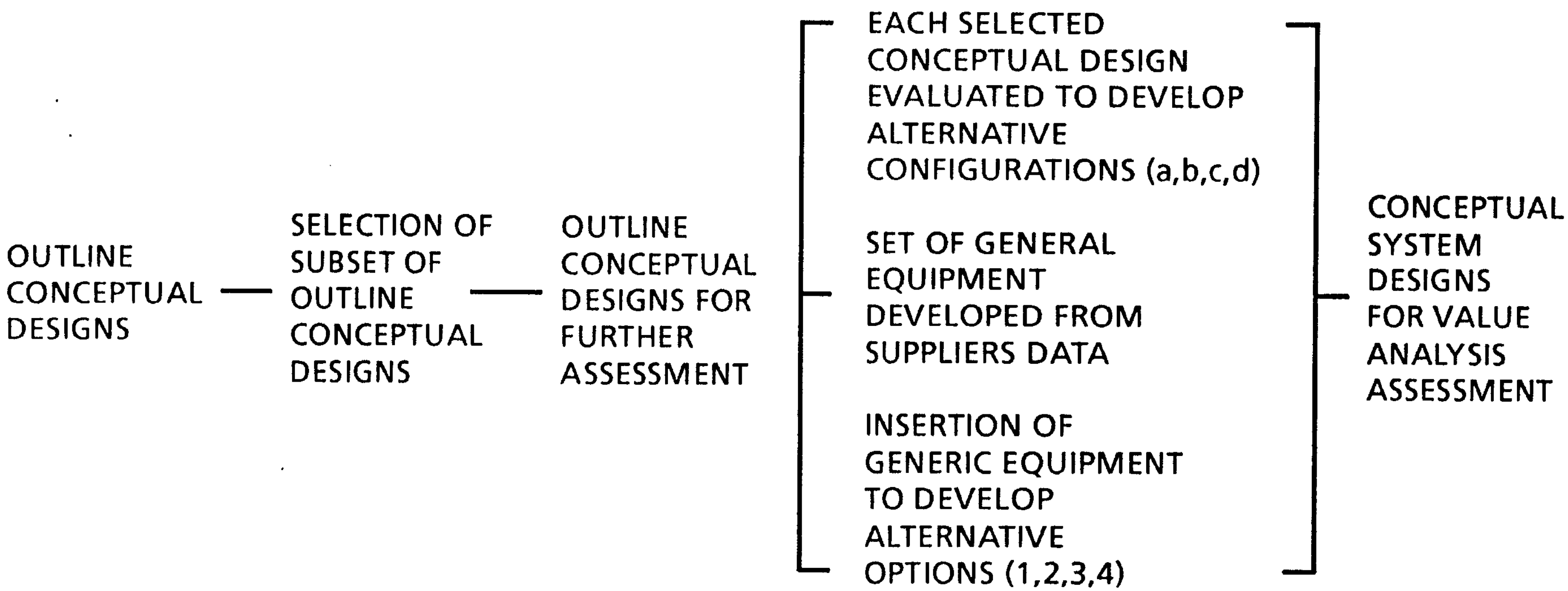
Liquids	
Sterilization	✓
Coalescence	x
Membrane separation	✓
Evaporation	x
Vap. compression distillation	R
Electrocoagulation	x
Supercritical water oxidation	x
Biological	✓
Hydrocyclones	x
Disinfection	✓

Solids	
Shredding / compaction +/- heat	✓
Water maceration	✓
Shredding	✓
Supercritical water oxidation	x
Biological	✓
Plasma combustion	x
Advanced incineration	✓
Electrochemical	x
Wet oxidation	x

Gaseous Emissions	
Vortex afterburner	✓
Non thermal plasma	✓
Adsorption	

✓ - included in designs
x - not available
R - recycle

Development Steps of Conceptual System Designs



Value Analysis Methodology

Introduction

- Methodology to assist with the selection of feasible waste treatment systems
- Extensively adapted from NATO NIAG Prefeasibility Study
- Adapted methodology tailored to UK Future Surface Combatant and for Retrofit
- Uses Generic Equipment Datasheets AND Conceptual System Designs as inputs

Valve Analysis

- Technical (attributes / ship integration)
- Risk
- Cost
- Residues

Value Analysis

A valuable tool

- Flexible approach (system / equipment)
- Adaptable (ship / mission)
- Responsive (rapid results)
- Simple to use

Integrated Systems - Option 1 (1)

- Destruction
  - Garbage and plastics (particle size reduced)
  - Dewatered food solids (pulped and pressed)
  - Clinical / sanitary waste (sterilised for interim storage)

- Biological membrane system
  - Vacuum collected black water
  - Pretreated grey and oily water
  - Liquid from food pulper / press

Integrated System - Option 1 (2)

- Other considerations

#Destruction process

- flue gas treatment for destruction process
- waste oil and sludge to destruction process
- grease / solids from grease traps to destruction

Biological membrane system

- biosludge held in process for shore disposal

Integrated System - Option 2

- Destruction system
  - vacuum collected black water
  - grease / solids from grease traps
  - oil / sludge from oily water separator
  - Garbage and plastics (size reduced)
  - Dewatered food solids (pulped / pressed)
  - Clinical / sanitary wastes

- Pre-treated liquids
  - Disinfection / polishing prior to discharge

Requirements for technology development

- Highly efficient destruction process for wide variety of solid wastes / sludges
- Flue gas treatment processes to ensure long term compliance
- Membrane bioreactors for black water and pre-treated grey and oily water
- System integration
- Process control

Evolution of Waste Management

A discussion regarding a decentralised treatment and transport system.

By Olle Lundberg, USON Marine, SE

Abstract

The presentation is focused on the present and growing problems regarding collection and transporting the waste from the source to the final waste handling area. The primary aspect being that the waste handling can not be kept in one central area if it is to be efficient for the crew to use. The central waste handling area will still be a most important function for final treatment/storage but it has to be supported by smaller sub systems that reduce time and space for the crew.

The paper considers the importance of the human factor in achieving a well functioning management through collection, transport and treatment aboard the ship. Factors that can reduce time spent handling waste and integrating the treatment in the work flow, making it as easy as possible for the crew to perform the correct handling.

The paper also describes simple techniques to pre-treat the waste close to the source as well as different transport methods for cutting transport frequency and time.

Uson Marine

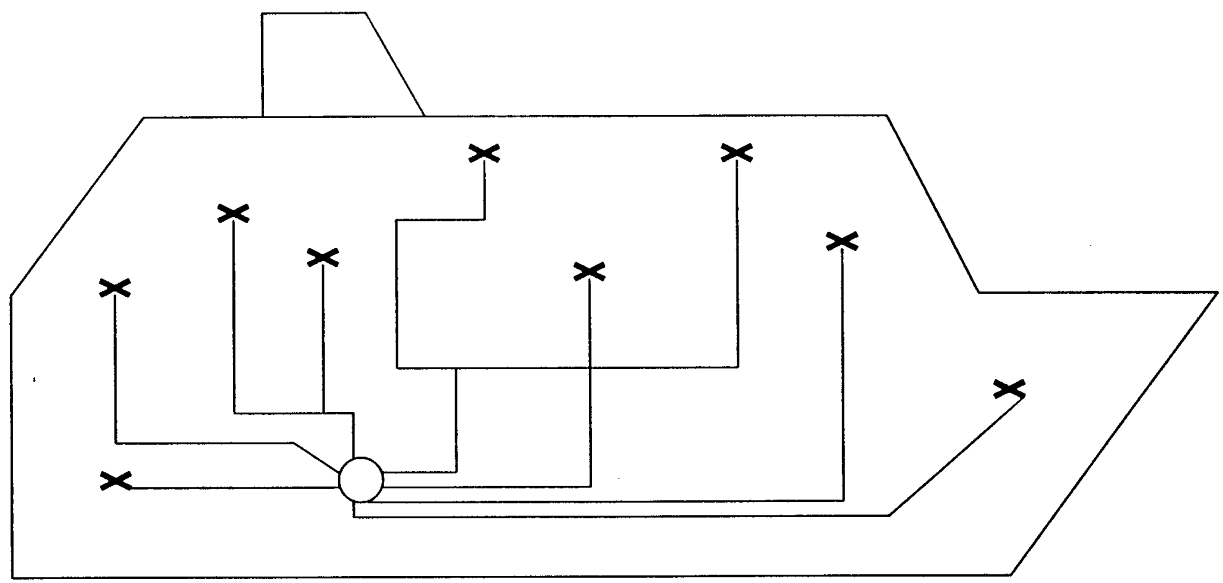
The easy way should be the right way

Evolution of waste management

- Review of current problems
- Factors with impact on system function
- System design
- Technologies used

USON MARINE

Current Problem



Good Waste Handling

- The easiest way for the crew to dispose of waste
- Minimise crew needed for waste handling, increase payable space
- The lowest impact on environment

It Can Be Done !

TSONJ MARINE

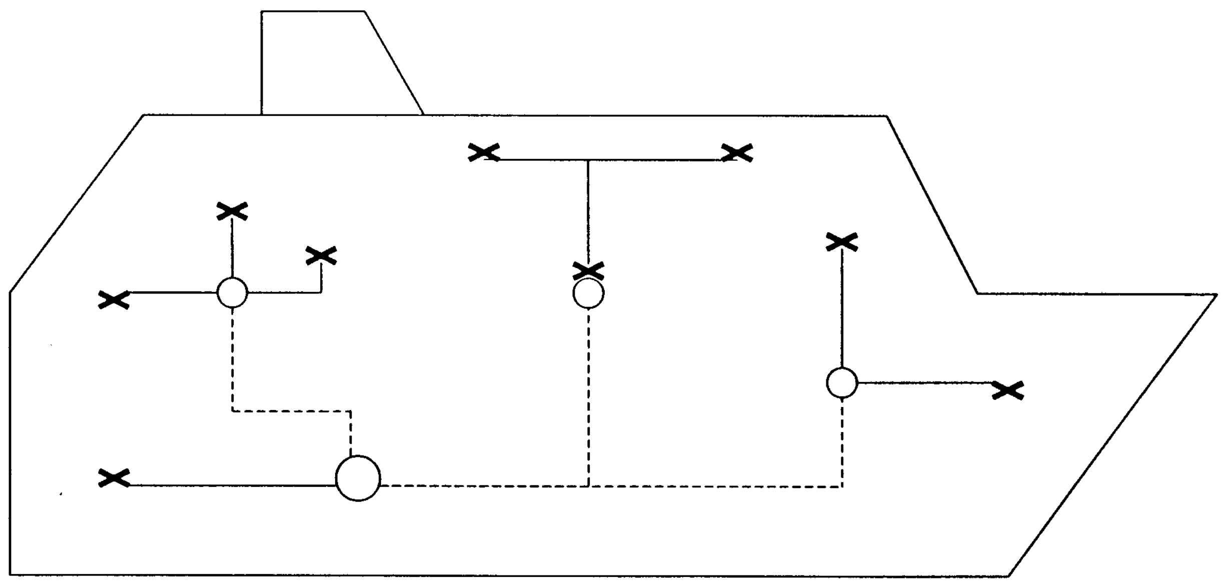
How?

- Make the treatment part of the natural work flow for the crew - The easiest way should be the right way
- Plan the material flow through the ship
- Sort at source, treat at source
- Minimise volume to transport
- Recycling of several fractions

System principles

- Several small systems gives flexibility and back-up
- Smaller pre-treatment stations reduce transport frequency as well as generates an automatic source sorting

Future Solution



The Human Factor

- Motivation of crew
- Easy disposal at source
- Minimum volume for manual transport

Example of Pre-Treatment Station Galley Area

- Tin Can Wash and Can Press(cold galley), Glass Crusher, Refrigerated General Waste Sack Compactor and Baling Press
- Easy to handle volume reduced fractions
- Food waste treated in working stations

Design of Pre-Treatment Station Pantry

- Glass Crusher
- Sack Compactor for general gaste and Aluminium cans.
- Sorting Cart

Transport Technologies

- Waste Chutes
- Vacuum Transport
- Sorting Carts

Conclusion

- Integrated subsystems will reduce both labour and labour space
- Lower operating cost
- Less dependency on few central systems, higher system availability through redundancy factors

S4P3-PICT.PDF

100

DEERBERG SYSTEMS

1756

DEERBERG-SYSTEMS has supplied Waste Management Systems and Components to more than 780 Vessels.

Thereof

Cargo: 650 **Navies: 26** **Research: 6**

PASSENGER VESSEL REFERENCES

Owner	Vessel's Name	Pers. Onboard
FERRY REFERENCES		
1. TT-Line	Peter Pan	2.000
2. TT-Line	Nils Holgersson	2.000
3. TT-Line	Nils Dacke	350
4. TT-Line	Robin Hood	350
5. Olau-Line	Olau Hollandia II	2.100
6. Olau-Line	Olau Britannia II	2.100
7. Birka-Line	Birka Princess	2.000
8. Prince of Fundy Cruise	Scotia Prince	1.770
9. Color Line	Venus	1.200
10. Sea Escape	Scandinavian Dawn	1.000
11. Silja Line	Silja Europa	3.000
12. TR-Line	Kahleberg	1.500
13. Swedish Ferry Line	Aurora of Helsingborg	1.500
14. Swedish Ferry Line	Tycho Brahe	1.500
15. DSR	Greifswald	200
16. Irish Ferries	Spirit of Innesfree	1.000
17. Superfast Enterprises	Superfast I	1.200
18. Superfast Enterprises	Superfast II	1.200
19. Shanghai Shipping Group	Zi Yu Lan	400
20. Shanghai Shipping Group	Xiang Xue Lan	400
21. Unity Line	Polonia	1.000
22. DSR	Mukran	200
23. DFO	Mecklenburg Vorpommern	600
24. Superfast Ferries	Superfast III	1.500
25. Superfast Ferries	Superfast IV	1.500
26. Cotunav	N.N.	
CRUISE VESSELS REFERENCES		
27. RCL	Crown Odyssee	1.600
28. Hapag Lloyd	Europa	1.100
29. Discoverer Reederei	Lindblatt Explorer	150
30. Aloha Pacific Cruises	Monterey	860
31. Star Cruises	Megastar Aries	120
32. Star Cruises	Megastar Taurus	120
33. NCL	Westward	1.200
34. Yacht Ship Italy	Renaissance I	170
35. Yacht Ship Italy	Renaissance II	170
36. Yacht Ship Italy	Renaissance III	170
37. Yacht Ship Italy	Renaissance IV	170
38. Yacht Ship Italy	Renaissance V	170
39. Yacht Ship Italy	Renaissance VI	170
40. Yacht Ship Italy	Renaissance VII	170
41. Yacht Ship Italy	Renaissance VIII	170
42. Chandris Cruises	Horizon	2.000
43. Chandris Cruises	Meridian	2.100
44. NYK	Asuka	850
45. Chandris Cruises	Zenith	2.000
46. White Star	Star Flyer	200

Owner	Vessel's Name	Pers. Onboard
47. White Star	Star Clipper	200
48. Star Cruises	Superstar Gemini	1.200
49. Cunard Crown	Crown Dynasty	1.200
50. Club Mediterranee	Club Med I	500
51. Diamond Cruises	Radisson Diamond	350
52. Effjohn	Sally Albatros	1.600
53. Black Sea Shipping	Taras Shevchenko	850
54. RCCL	Nordic Empress	2.600
55. Seaborn Cruise Line	Seaborn Pride	330
56. Seaborn Cruise Line	Seaborn Spirit	330
57. P&O/Princess	Star Princess	2.300
58. P&O/Princess	Crown Princess	2.300
59. P&O/Princess	Regal Princess	2.300
60. P&O	Oriana'	2.900
61. P&O/Princess	Sun Princess'	3.100
62. P&O/Princess	Dawn Princess'	3.100
63. P&O/Princess	Grand Princess'	4.500
64. P&O/Princess	Sea Princess'	3.100
65. P&O/Princess	Ocean Princess'	3.100
66. P&O	Aurora	3.100
67. Hanseatic Reederei	Hanseatic'	320
68. KCL	Royal Viking Queen	330
69. Majesty Cruise Line	Royal Majesty	1.750
70. Deilmannn	Lily Marleen	50
71. Silversea Cruises	Silver Wind	500
72. Silversea Cruises	Silver Cloud	500
73. Black Sea Shipping	Kazakhstan II	700
74. Black Sea Shipping	Gruziya	550
75. RCCL	Legend of the Seas	2.800
76. RCCL	Splendour of the Seas	2.800
77. Star Cruises	Star Aquarius'	2.700
78. Star Cruises	Star Pisces	2.700
79. CCL	Fascination	3.500
80. CCL	Imagination	3.500
81. CCL	Inspiration'	3.500
82. Costa Crociere	Costa Victoria	3.000
83. NCL	Norwegian Sky	3.000
84. Hapag Lloyd	Bremen	280
85. Deilmann	Deutschland	650
86. Hapag Lloyd	Columbus	600
87. DSR	Aida'	1.500
88. DSR	Arkona	800
89. Star Cruises	Superstar Leo	4.240
90. Star Cruises	Superstar Virgo	4.240
91. Royal Olympic	N.N.	1.400
92. Royal Olympic	N.N.	1.400
93. Hapag Lloyd	Europa II	700
94. Carnival Corporation	N.N.	3.600
95. Carnival Corporation	N.N.	3.600
96. Carnival Corporation	Option'	3.600
97. Carnival Corporation	Option'	3.600
98. Carnival Corporation	Option	3.600
99. Princess Cruises	Grand Princess II'	4.500
100. Princess Cruises	Grand Princess III	4.500

March 1999

'equipped with the MPWMS (MULTI PURPOSE WASTE MANAGEMENT SYSTEM) means, the owner can decide from day to day to operate in a **SORTING** or **NON-SORTING** mode to fulfill his own GREEN SHIP PHILOSOPHY

From 100 large applications 28 are equipped with the DEERBERG MPWMS.

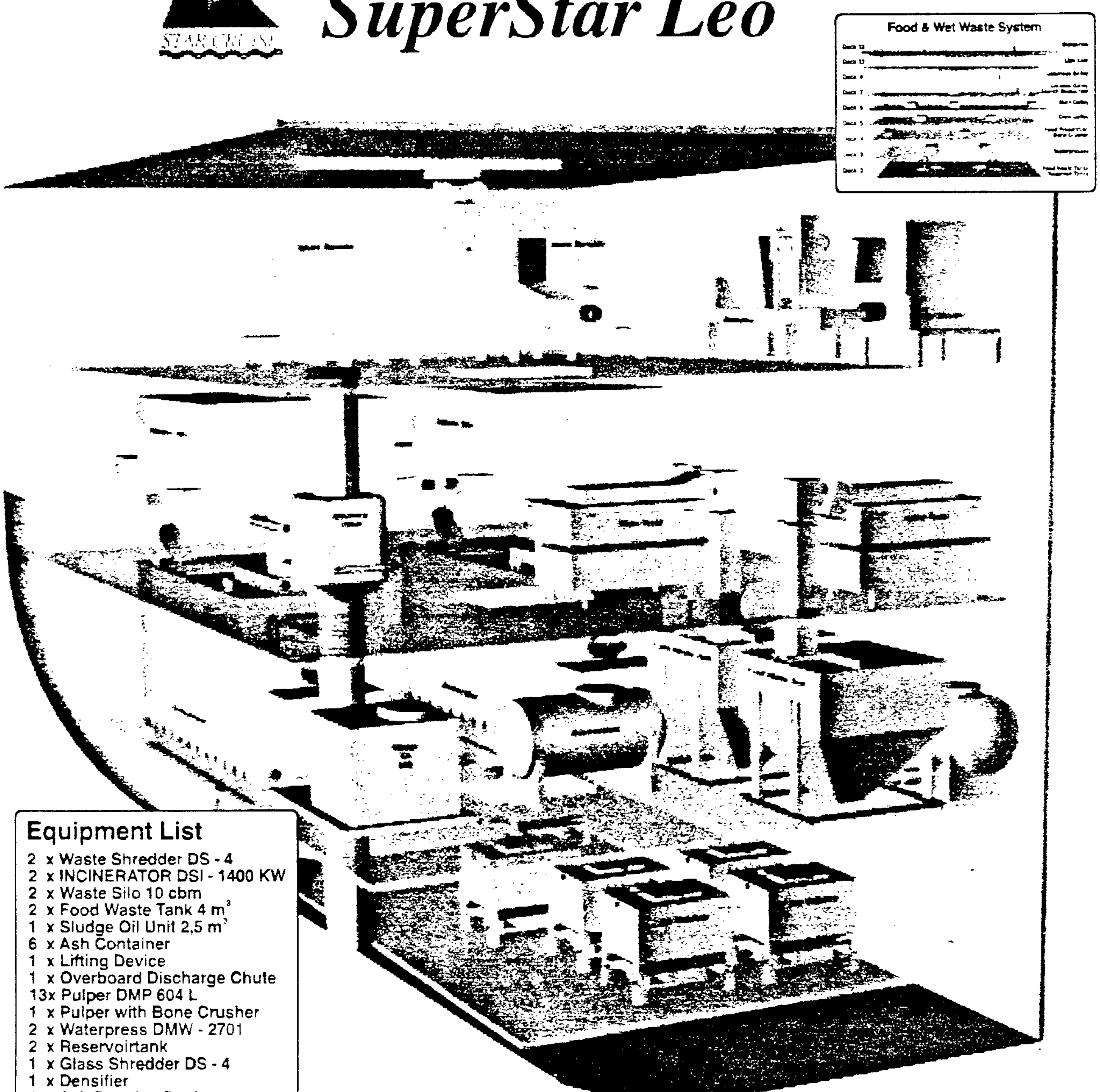
DEERBERG-SYSTEMS · Moltkestraße 6A · D-26122 Oldenburg
Telefon +49-(0) 441-973 57-0 · Fax +49-(0) 441-77 73 37

DEERBERG SYSTEMS

STATE-OF-THE-ART

DEERBERG MULTI PURPOSE WASTE MANAGEMENT SYSTEM

SuperStar Leo



Equipment List

2 x Waste Shredder DS - 4
2 x INCINERATOR DSI - 1400 KW
2 x Waste Silo 10 cbm
2 x Food Waste Tank 4 m³
1 x Sludge Oil Unit 2,5 m³
6 x Ash Container
1 x Lifting Device
1 x Overboard Discharge Chute
13x Pulper DMP 604 L
1 x Pulper with Bone Crusher
2 x Waterpress DMW - 2701
2 x Reservoirtank
1 x Glass Shredder DS - 4
1 x Densifier
1 x Ash Bagging Device

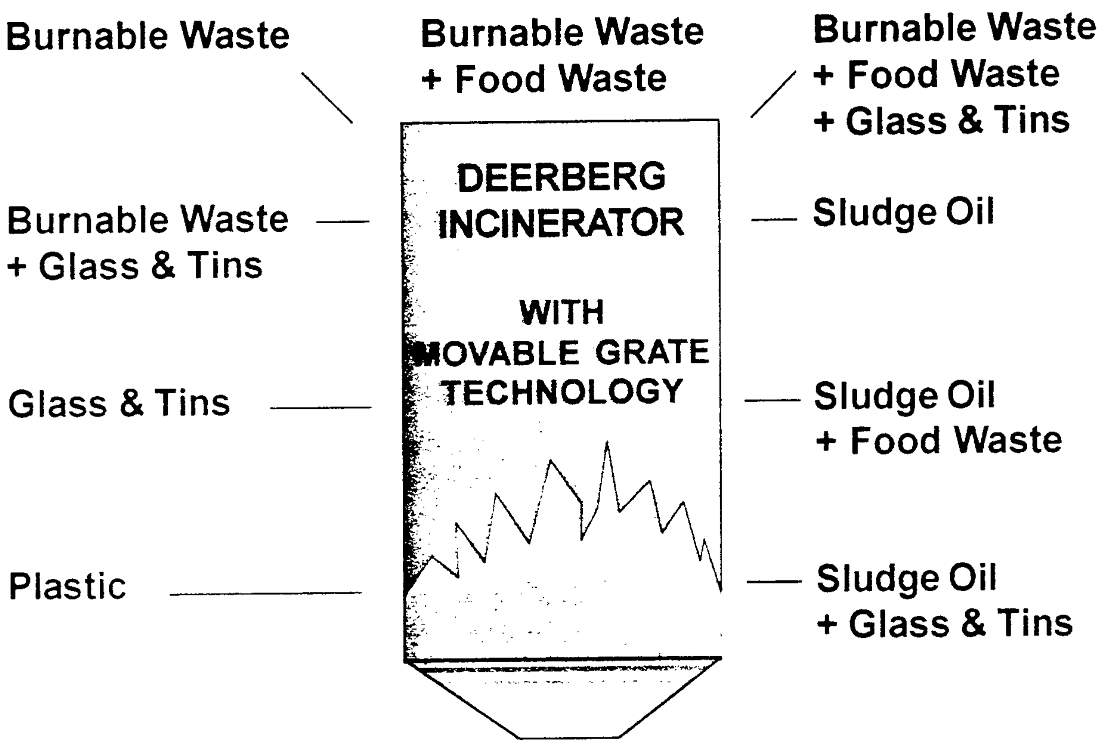
THE WASTE MANAGEMENT SYSTEM CAN BE OPERATED IN A SORTING OR NON SORTING MODE

YOUR WORLDWIDE No. 1 PARTNER FOR WASTE MANAGEMENT SYSTEMS

DEERBERG-SYSTEMS · Moltkestraße 6 A · D-26122 Oldenburg · Telephone: +49-(0)441-97 35 7-0 · Telefax: +49-(0)441-77 73 37 · E-mail: DeSysOl@aol.com

CONSEQUENCES FOR THE ONBOARD OPERATION

Treatment of waste in following combinations possible:



CLEAN ASH, 100% DESINFECTED
acc. to EPA toxity list

BACTERIA FREE - NON HAZARDOUS
NOT SMELLING

The answer to an optimal treatment of all different types of garbage onboard Cruise Vessels is the DEERBERG MULTI PURPOSE INCINERATOR EQUIPPED WITH MOVABLE GRATE TECHNOLOGY.

SHIPPING & SHIPBUILDING INDUSTRY

MV CAPT. EULE

CERTIFICATE

for the quality of
Ash & Residuals
disposed to shore

Herewith we certify that the **Ash** (incl. Residuals like e.g. Glas & Tins) which is landed onshore has passed the onboard Incineration System and is therewith classified **acc. to EPA, USDA, Derm** as

BACTERIA FREE
NON HAZARDOUS
NOT SMELLING

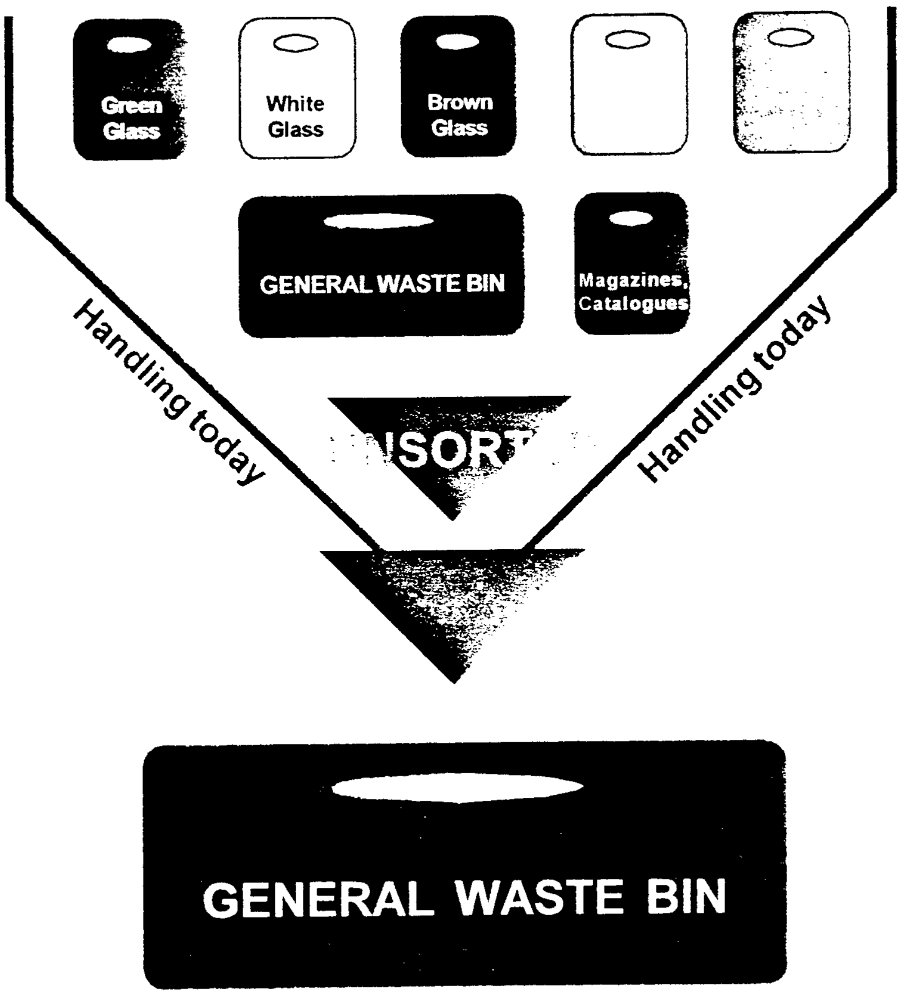
Captain

Chief Engineer

FUTURE WASTE MANAGEMENT TREND

EXAMPLE FROM 2 EUROPEAN CAPITOLS

PRIOR STATUS: MINI RECYCLING CENTERS



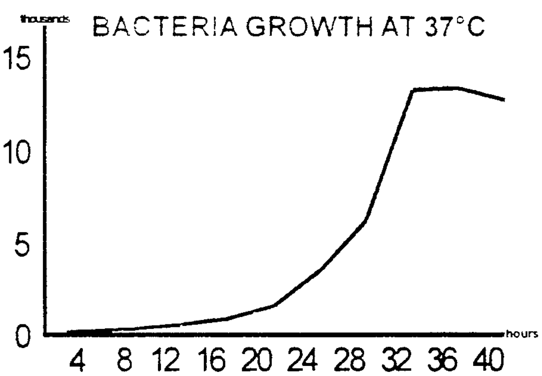
TODAY'S STATUS: ONLY ONE GENERAL WASTE BIN

This trend is also influencing the Waste Management Procedures onboard Cruise Ships. These have to prepare their residual landing according to onshore habits. Future **NON-SORTING** trend can be clearly foreseen.

REGULATION OF ONSHORE DISPOSAL

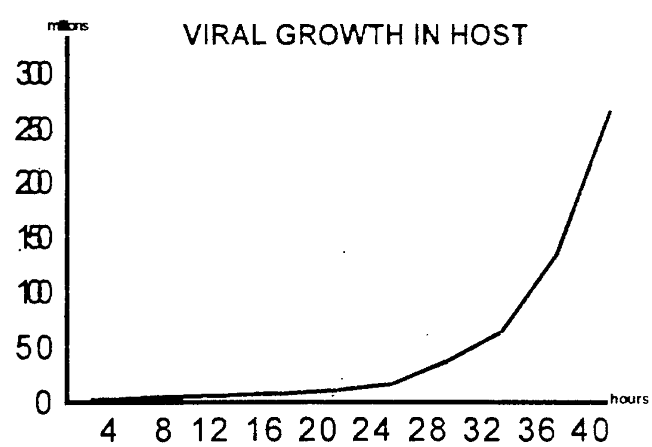
WHY COUNTRIES REGULATE THE DISPOSAL OF CONTAMINATED WASTE FROM INTERNATIONAL CARRIERS

1) DISEASE PREVENTION
2) PLANT PEST CONTROL
3) PROTECTION OF WASTE LANDFILLS



Example of virus and bacteria growth in contaminated garbage !

The only way to destroy such bacterias and viruses is the onboard INCINERATION and DESINFECTION !!!!



PEOPLES AWARENESS

- „THE WORLD IS A VILLAGE“

- GLOBALIZATION

  IS ENVIRONMENTALWISE A
  MAJOR PROBLEM

- WORLD-WIDE TRADING / TRAVELLING

  BACTERIA AND ILLNESS IMPORT
  TO FOREIGN COUNTRIES

- ONSHORE LANDING OF GARBAGE:

  STRICLT CONTROL BY
  AUTHORITIES AND LOCAL
  ONSHORE RECEIVERS

- OWNERS RESPONSIBILITY:

  BACTERIA FREE,
  NON-HAZARDOUS
  ONSHORE LANDING OF RESIDUALS

DEERBERG SYSTEMS

WASTE HANDLING IS REGULATED BY INTERNATIONAL RULES

- IMO — International Maritime Organisation
- EPA — Environmental Protection Agency
- USDA — United States Department for Agriculture
- DERM — Department of Environment Resources Management
- USCG — United States Coast Guard
- USPHS — United States Public Health Services
- Future rules for emissions etc.
- **Local** rules — ALASKA - LOS ANGELES - MIAMI - HELSINKI - ATHENS - ISTANBUL - FUNCHAL - HONG KONG - HAWAII ....
- TREND: WORLDWIDE ACCEPTANCE ONLY OF DESINFECTED, BACTERIA FREE, NOT SMELLING RESIDUALS !!!

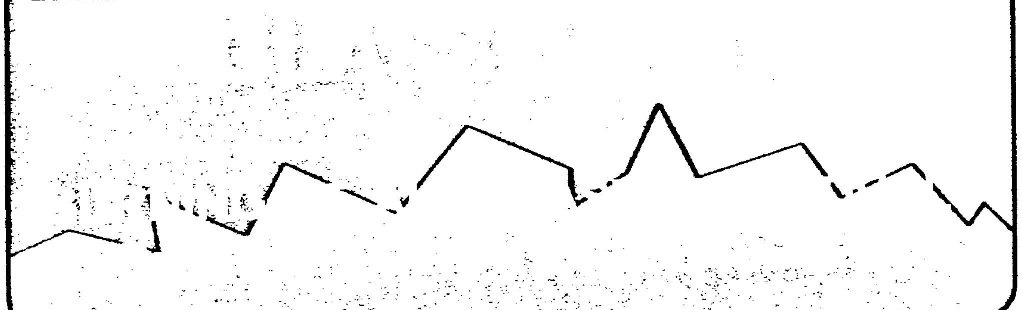
  NO BACTERIA IMPORT/EXPORT TO FOREIGN COUNTRIES

WASTE TREATMENT ONBOARD

DESINFECTION OF GLASS & TINS

PASSING OF SORTED OUT GLASS & TINS THROUGH INCINERATOR FOR A DESINFECTED ONSHORE LANDING

DESINFECTION OF:



RESULT :

DESINFECTED GLASS & TINS

WORLDWIDE ONSHORE LANDING POSSIBLE

OVERBOARD DISCHARGE WHERE ALLOWED

DEERBERG SYSTEMS

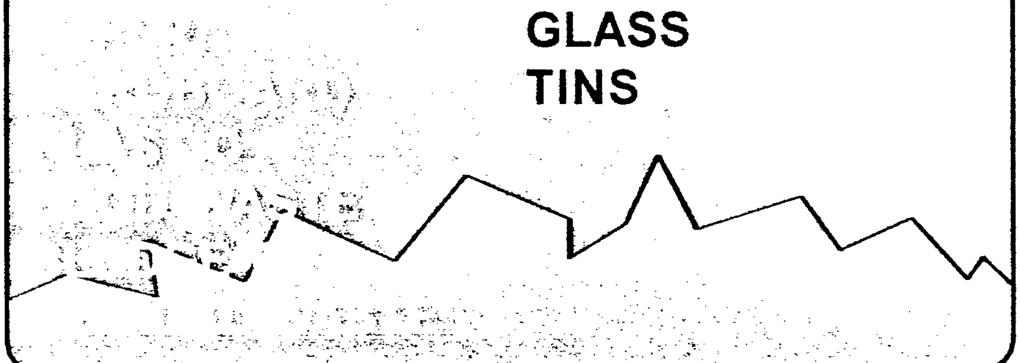
WASTE TREATMENT ONBOARD

NON-SORTING OPERATION

UNSORTED PASSING OF ALL WASTE RESIDUALS THROUGH THE INCINERATOR

AND DESINFECTION OF:

GLASS
TINS



RESULT :

DESINFECTED ASH (INCL. GLASS & TINS)

100% FULFILLMENT OF INT. & LOCAL RULES

WORLDWIDE ONSHORE LANDING POSSIBLE

LATER ON RECYCLING POSSIBLE IN DIFFERENT WAYS

SAFE AND EASY CONCEPT
FULFILLING ALL RULES ALSO IN 2020

WASTE TREATMENT ONBOARD

SORTING OPERATION

INCINERATION OF:

(PAPER)
(CARDBOARD)
PLASTIC
FOOD WASTE
SLUDGE OIL
MEDICAL WASTE

RESULT :

DESINFECTED ASH

100% FULFILLMENT OF INT. & LOCAL RULES AND REGULATIONS

WORLDWIDE ONSHORE LANDING POSSIBLE

RECYCLING OF:

GLASS
TINS
(PAPER)
(CARDBOARD)

RESULT :

UNDESINFECTED GLASS & TINS...

NO FULFILLMENT OF RULES AND REGULATIONS

FUTURE ONSHORE LANDING DIFFICULT AND LIMITED

DEERBERG SYSTEMS

WASTE MANAGEMENT DEVELOPMENT

until 1975

Waste Management Philosophy was

„OUT OF SIGHT, OUT OF MIND“

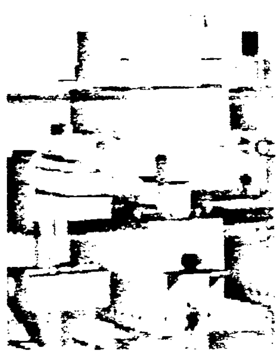
First Waste Management Equipment installed for volume reduction of the onboard accumulated garbage.

1980

First 3-Deck Incineration System installed onboard MS NORWAY by NH

around 1980

Sorting, Sorting, Sorting



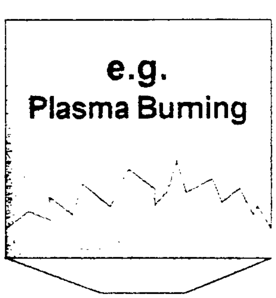
in 1989

First Incinerator with Movable Grate Technology

= **MULTI PURPOSE WASTE MANAGEMENT**

= **SORTING & NON-SORTING OPERATION**

= fulfillment of requirementsfrom onshore receiving facilities!



Future Technologies

Advanced Incineration technologies like Plasma-Burning or Incinerators with higher temperature

DEERBERG SYSTEMS

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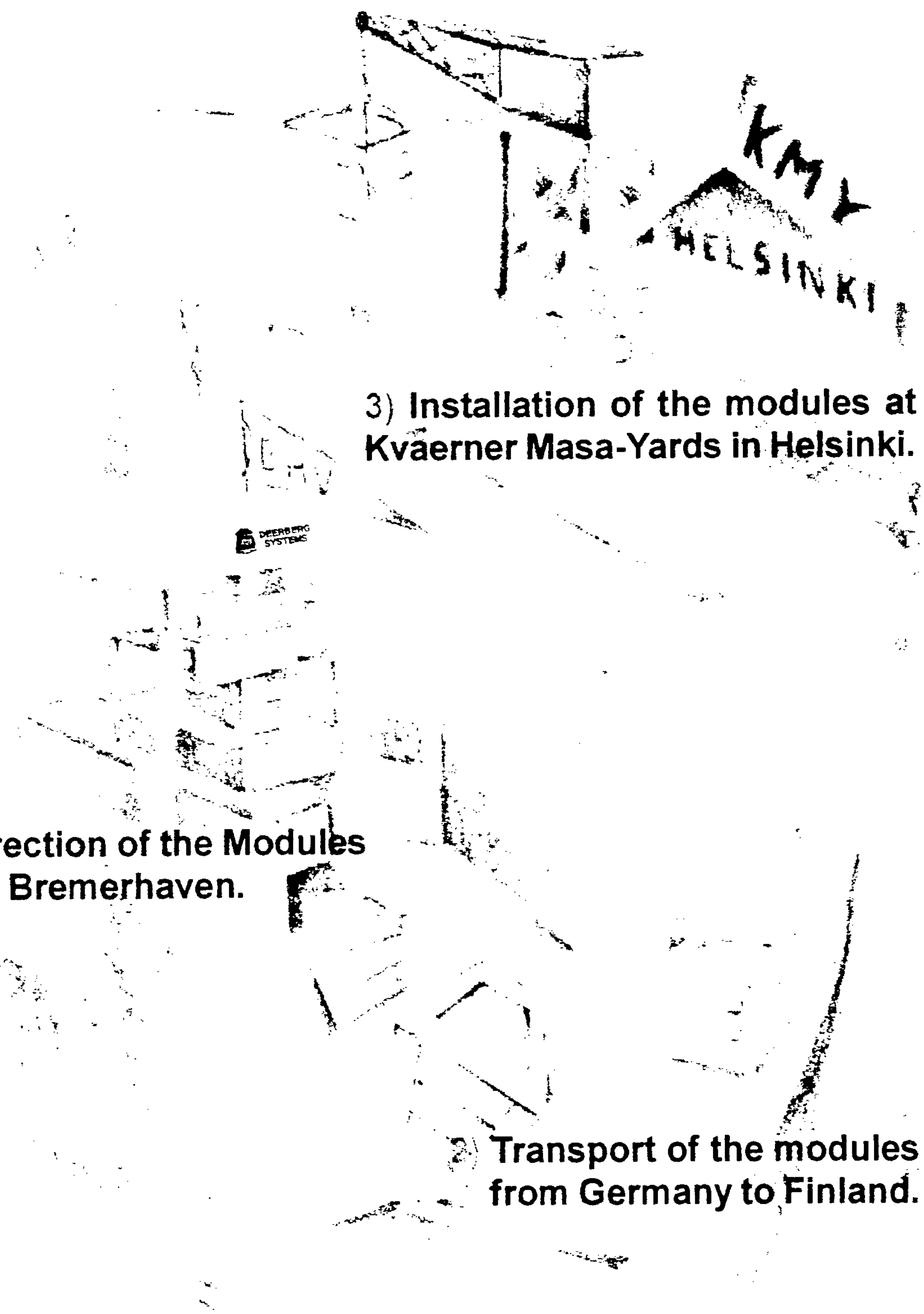
TURN-KEY DELIVERY OF TWO WASTE MANAGEMENT MODULES



3) Installation of the modules at Kvaerner Masa-Yards in Helsinki.

1) Erection of the Modules in Bremerhaven.

2) Transport of the modules from Germany to Finland.

DEERBERG SYSTEMS

DEERBERG WASTE MANAGEMENT MILESTONES

1987 World-wide first order for **Star Princess** for an **Integrated Food & Wet Waste System**

1988 World-wide largest installation **Nordic Empress** of a **Total Waste Management System**

1990 World-wide first Incinerator on **Hanseatic** installed with **Movable Grate Technology**

1991 World-wide first Company using **Stainless Steel for Food Waste Systems**

1992 World-wide first privately organized **Environmental Workshop in Miami**
75 Participiants from Owners, Yards and Authorities

1993 World-wide first advanced Food Waste System operating **with PLC Control, Heavy Duty Waterpresses and Easy Service Pulpers**

1984 1999 **Lecture No. 40 given during the Conference Solid Waste Treatment Technologies for Ships by Jochen Deerberg**

1999 World-wide first delivery for **NB 498/499** of two **Turn-Key Waste Management Modules**

1999 100 Large Passenger Vessels supplied with a Deerberg Waste Management System

DEERBERG
SYSTEMS

DEERBERG HISTORY

DEERBERG BROCHURE FROM 1936

1756 **COMPANY DEERBERG**
Founded as Blacksmith´s shop

1999 **STRONG LEADING DEPARTMENT STORE CHAIN**
Under Management of K.W. Deerberg

Activities Jochen Deerberg

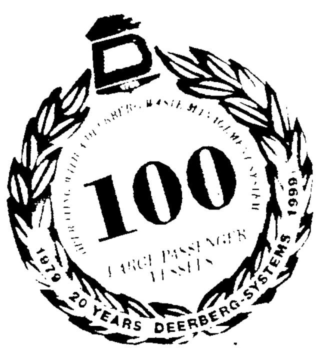
1979 **DEERBERG-SYSTEMS**
CONSULTANCY

1983 **DEERBERG-SYSTEMS**
Waste Management Systems

1985 **DEERBERG-TRADING**
General Trading
e.g. Import from Dominican Rep.

1999 **DEERBERG-SYSTEMS**

- 20 TH ANNIVERSARY
- Leading Supplier **for Waste Management Systems onboard Ships**
- 100 **Waste Management Systems installed on large Passenger Vessels**
- **and 700 OTHER SHIPS**



QUALITY IN TRADITION SINCE 240 YEARS

GENERAL TARGET

The general target of environmental protection is nothing else than trying to guarantee, that even our children`s children can still enjoy beaches like this ...

DEERBERG SYSTEMS

PHILOSOPHY AND TECHNOLOGY FOR A MULTI PURPOSE WASTE MANAGEMENT SYSTEM TODAY AND BEYOND 2000

THE OCEANS ARE OUR GLOBAL COMMONS

Lecture No. 40

GIVEN BY

JOCHEN DEERBERG
OWNER & CEO

AT THE INTERNATIONAL CONFERENCE AND EXHIBITION
„SOLID WASTE TREATMENT TECHNOLOGIES FOR SHIPS“

ANTWERP, CROWNE PLAZA, APRIL 23, 1999

• The Maritime Environment •

"Solid Waste Treatment Technologies for Ships"

Supplement

Participants in the Conference "Solid Waste Treatment Technologies for Ships"

April, 21st - 23rd 1999, Antwerp / Belgium

Company	Name	Titel	First Name	Address			Telephone	Telefax
				Nation: **BE**				
Antwerp Port Authority	**Byninckx**		Eddy	Entreprokaai 1	2000	Antwerp	+32 3 205 2011	+32 3 205 2020
Antwerp Port Authority	**De Crop**		Patrick	Entreprokaai 1	2000	Antwerp	+32 3 205 2011	+32 3 205 2020
Antwerp Port Authority	**van Meel**		Guido	Entreprokaai 1	2000	Antwerp	+32 3 205 2011	+32 3 205 2020
ECOLAS NV	**Le Roy**		Dirk	Lange Nieuwstraat 43	2000	Antwerpen	+32 3 2350703	+32 3 2338190
Indavar N.V.	**Moerman**		Erik	Poldervlietweg 2	2030	Antwerpen	+32 3 568 4911	+32 5684999
Marpobel nv	**De Lannoy**		Frans-Josef	Blauweweg 7	2030	Antwerpen	+32 3 542 14 89	0032 3 541 33 43
NATO HQ, IS DS Nav. Armts	**Simi**	Capt. (ITN)	Archangelo		1110	Brussels	+32 2 7284172	+33 2 7284103
Port of Antwerp	**De Rache**		Paul	Siberia Straat 20, Haven 63	2030	Antwerp	+32 3 2052425	+32 3 2052437
Port of Antwerp	**Vanderhallen**		Joris	Siberia Straat 20, Haven 63	2030	Antwerp	+32 3 2052425	+32 3 2052437
Tourist Office Antwerp	**Boogaert**		Annik	Groote Markt 15	2000	Antwerp	+32 3 2320103	+32 3 2311937
				Nation: **FR**				
C M B	**Filliat**		Jean-Paul	Z.I. Ouest-BP 4011-Veyziat	01114	Oyonnax Cedex	+33 474 819 600	+33 474 734 385
Chantier De L'Atlantique	**Le Padellec**		Joseph	BP 400	44608	Saint-Nazaire Cedex	+33 2 5110 9154	+33 2 5110 4878
DCN Brest	**Bathany**		Daniel	SDEE/MACH Brest Naval	29240	Brest	+33 2 98 22 51 20	+33 2 98 22 69 99
				Nation: **FI**				
Taifun Engineering Oy Ltd.	**Bärlund**		Mårten	Nuijamiestentie 5B	00400	Helsinki	+358 9 241 15 22	+358 9 47 76 05 77
Taifun Engineering Oy Ltd.	**Rinne**		Kari	Nuijamiestentie 5B	00400	Helsinki	+358 9 241 15 22	+358 9 47 76 05 77
				Nation: **GE**				
	Altenberg	Dipl.Ing.	Claus	Apenrader Str. 22	27580	Bremerhaven	+49 471 801187	
B W B - SG 15	**Spetzler**		Hans-Christian	Ferdinand-Sauerbruch Straße 1	56073	Koblenz	+49 261 400 4191	+49 261 400 4339
Blohm&Voss GmbH	**Möller**	Dipl.Ing	Petra	Herm.-Blohm-Str. 3	20457	Hamburg	+49 40 31 1916 78	+49 40 31 19 34 26
DEERBERG-SYSTEMS	**Deerberg**		Jochen	Moltkestraße 6A	26122	Oldenburg	+49 441 973 570	+49 441 75301
DEERBERG-SYSTEMS	**Ehbrecht**		Ingo	Moltkestraße 6A	26122	Oldenburg	+49 441 973 570	+49 441 75301
Dr. Weßling Beratende Ingenieure	**Brüß**	Dipl.Bio.	Ulrich	Oststraße 7	48341	Altenberge	+49 2505 89 805	+49 2505 89 279
Lindau Entsorgungstechnik GmbH	**Wittkamp**		Uwe	Südstraße 48	59227	Ahlen / Westf.	02382 803590	02382 803591

Company	Name	Titel	First Name	Address			Telephone	Telefax
					Nation: GR			
Environmental Protection Engineering 4080190	+301 4617423		Polychronopoulos		Helen	24, Dervenakion Str.	18545	Piraeus +301
					Nation: IT			
Costa Crociere	**Anderson**		Sonia	Via de Marini 60	16149	Genova	+39 335 441298	
ISIR S.p.A.	**Mazza**		Nicola	Via Luigi Canepa, 16r	16165	Genova	+3910 84181	+3910 803307
					Nation: NL			
Min. Transport & Public Works	**Bolt**		Klaas Jan	P.O. Box 20940	2500 EX	The Hague	+31 70 351 1560	+31 70 351 1548
Rotterdam Municipal Port	**de Keyzer**	Capt.	Cornelius	P.O.Box 6622	3002	AP Rotterdam	+31 10 2521575	+31 10 4767809
					Nation: NO			
Mjörud AS	**Hovland**		Frank	PO Box 184, Teie	3106	Tönsberg	+47 33 351040	+47 33 351041
Norwegian Union of Marine Engineers	**Andersen**		Helge	P.O.Box 7153 Majorstua	0307	Oslo	+47 23366180	+47 22568610
Scanship Engineering AS	**Holbu**		Jan Willie	Kanalveien 4	3101	Tønsberg	+47 33 31 0044	+47 33 31 82 57
Scanship Engineering AS	**Løkken**		Reidar	Kanalveien 4	3101	Tønsberg	+47 33 31 0044	+47 33 31 82 57
Team Tec A.S.	**Kyed**		Jorgen	Kavringstrandvm.	1450	Nesoldtangen	+47 66 911619	
Team Tec A.S.	**Nielsen**		Torben	Nyvei 41, PO Box 203	4901	Tvedestrand	+47 37 199800	+47 37 199890
					Nation: SE			
Uson Marine AB	**Lundberg**		Lars	P.O. Box 10462	10462	Stockholm	+46 8 6405900	+46 8 6448282
Uson Marine AB	**Lundberg**		Olle	P.O. Box 10462	10462	Stockholm	+46 8 6405900	+46 8 6448282
					Nation: SP			
D.E.T.E.G.A.S.A.	**Loureda**		Juan	Ctra. Castro-Meiras, Tuimil-Sequei	15550	Valdoviño / La Coruña	+349 81 48 54 44	+349 81 48 63 52
					Nation: UK			
A E A Technology	**Oakley**		Denise	Culham, Abingdon		Oxfordshire OX14 3DB	+44 1235 463105	++44 1235 463001
Hamworthy KSE Ltd.	**Smith**		Alan	Fleets Corner		Poole, Dorset BH17 0JZ	+44 1202 662680	+44 1202 662818
Morgan Automation LTD	**Clarke**		Howard M.	Rake Heath House, London Road		Liss, Hants. GU33 7NT	+44 1730 895900	+44 1730 895922
Office of Naval Research	**Vodyanoy**	Dr.	Igor	223/231 Old Marleybone Road		London NW1 5^{th}	+44 171 5144539	+44 171 7236359

Company	Name	Titel	First Name	Address		Telephone	Telefax
Strachan & Henshaw Ltd.	**Hawkins**		Nick	Ashton Vale Road	Bristol BS99 7TJ	+44 117 9664677	+44 117 9634259
Strachan & Henshaw Ltd.	**Roynon**		Kelvin	Ashton House, Ashton Vale Road	Bristol BS99 7TJ	+44 117 966 4677	+44 117 963 4259
				Nation: **US**			
Carnival Cruise Lines	**Garcia**		Alberto	3655 NW 87 Avenue	Miami, Fl 33178	+1 305 599 2600	+1 305 406 4670
Chief of Naval Operation	**Koss**		Lawrence	Pentagon	Bethesda MD 20816	+1 703 602 2562	+1 703 602 5364
GEO-CENTERS, INC.	**Bailey**		William	1755 Jefferson Davis Hwy - Suite 910	Arlington, VA. 22202	+1-703- 416-1023	+1-703- 416-1178
GEO-CENTERS, INC.	**Bryce**	Cdr	Dexter	1755 Jefferson Davis Hwy - Suite 910	Arlington, VA. 22202	+1-703- 769-1891	+1-703- 769-1885
Naval Sea Systemes Command	**Check**	Capt.	Pete	2211 S. Clark Place, Suite 678	Arlington, VA 22244-5108	+1 703 602 2551	+1 703 602 1982
Naval Sea Systems Command	**Krinsky**		Joel	2531 Jefferson Davis Hwy	Arlington VA 22242 -5160	+1 703 602 0547	+1 703 602 8010
Naval Surface Warfare Center	**McCraw**		Peter	9500 MacArthur Blvd	West Bethesda MD 20817 -		
Retech services, Inc.	**Eschenbach**	Dr.	Richard	PO Box 997	Ukiah,CA 95482	+1-707-462-6522	+1-707-462-4103
Retech services, Inc.	**Gehrman**		Fred H.	PO Box 997	Ukian,CA 95482	+1-707-467-1721	+1-707-468-9227
Retech services, Inc.	**Reaney**		David W.	PO Box 997	Ukian,CA 95482	+1-707-467-1764	+1-707-468-9227
Retech services, Inc.	**Shuey**		Mark	PO Box 997	Ukian,CA 95482	+1-707-467-1721	+1-707-468-9227
Retech services, Inc.	**Womack**		Ronald K.	PO Box 997	Ukian,CA 95482	+1-707-467-1721	+1-707-468-9227

LOCKHEED MARTIN

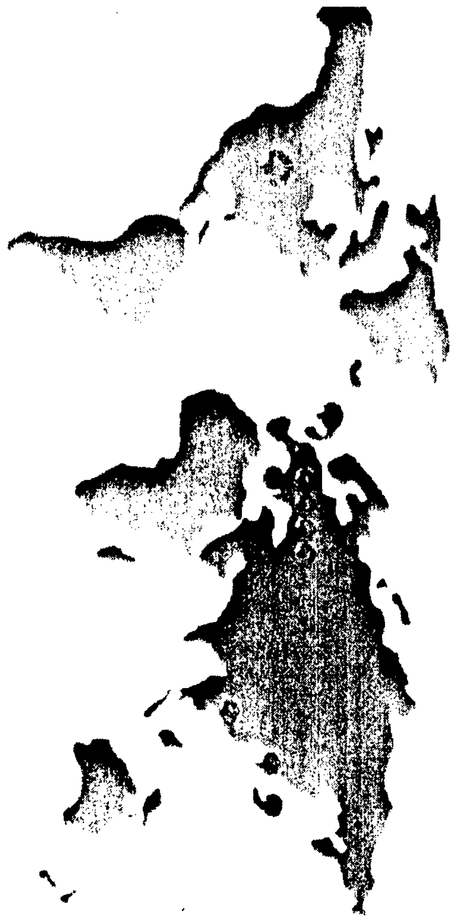
RETECH SERVICES, INC.

A Lockheed Martin Company

TREATMENT SYSTEMS GROUP
UKIAH, CALIFORNIA

For more information on Retech,
or to receive new literature on
the PACT system,
contact Ron Womack,
at (707) 467-1721.

Retech Services Inc.,
A Lockheed Martin Company
100 Henry Station Rd.,
P.O. Box 997
Ukiah, CA 95482



Providing Global Solution
for Worldwide Clientele

USA
China
Japan
Korea
U.K
France
Belgium
Switzerland
Germany
Austria
Italy

A Brief History of Retech

Founded in 1963, Retech's original line of business focused on the development of technology and manufacturing equipment for the special metals trade — particularly the aerospace industry. One of the technologies employed by Retech was plasma melting, using plasma to form a plasma arc. Retech soon applied its plasma expertise to the cleanup of waste, including hazardous, radiological, medical and other waste streams.

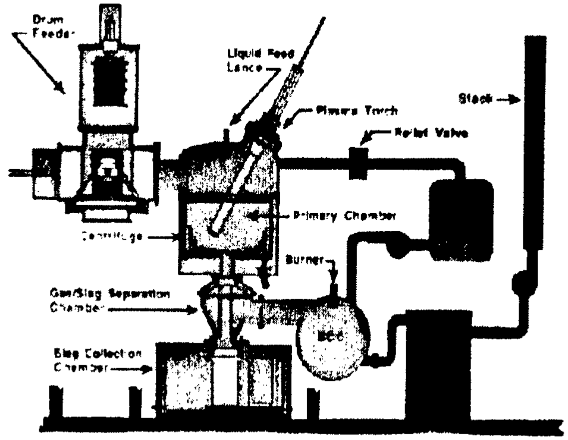
The PACT Advantage

Research and development of the PACT process at Retech includes an in-house, laboratory-scale PACT unit

Retech's patented Plasma Arc Centrifugal Treatment system (PACT) offers turnkey solutions to an assortment of waste treatment challenges. PACT systems effectively treat more difficult waste streams than any other process and meet all applicable waste treatment standards, as well as disposal requirements for the stabilized slag byproduct. Significant volume reduction as well makes the PACT process one of the most efficient, safe and diverse solutions for the treatment of difficult waste.

The PACT Process

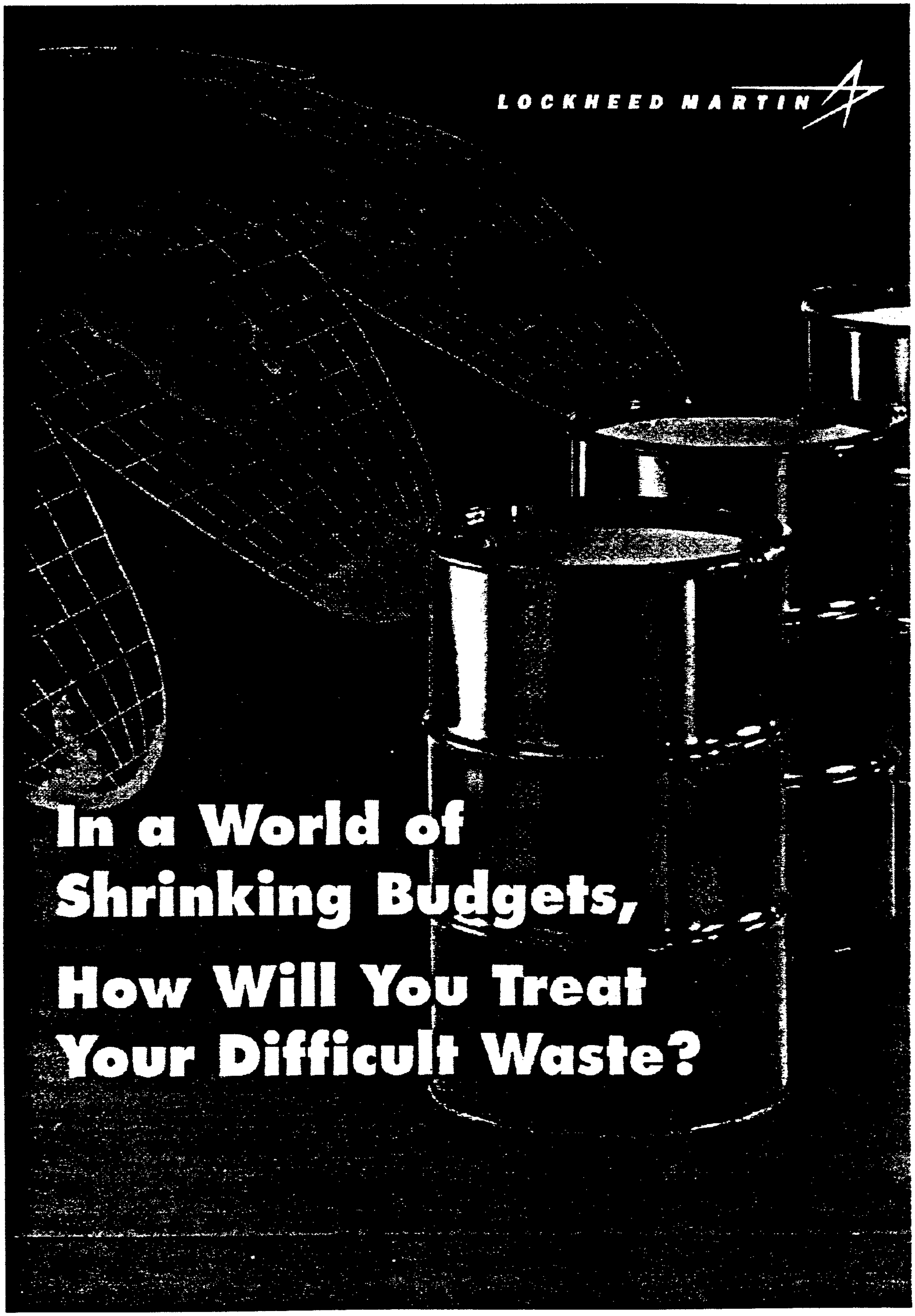
Retech's Plasma Arc Centrifugal Treatment technology uses heat generated from a plasma torch to treat hazardous/radioactive, waste containing heavy metals and/or organics. Metal-bearing solids and soil are melted by the process, while organic contaminants are thermally destroyed. The molten material forms a hard, glass-like, leach-resistant mass after cooling in a mold. Contaminated material is placed in a bulk screw feeder and gradually fed into the centrifuge. Solid material is retained in the centrifuge by centrifugal force while a transferred plasma arc heats the material in an oxygen-containing atmosphere to temperatures sufficient to melt soil. Any incompletely burned gases or products of incomplete combustion are eliminated in a secondary treatment chamber downstream of the centrifuge. Once enough feed material is treated, the centrifuge slows and the molten mass flows into a slag collection mold.



A Look at PACT Development

A brief history of PACT is listed below:

- **1985** - Initial work with Plasma Arc Centrifugal Treatment concept began.
- **1987** - First test conducted in lab-size furnace (PACT-1.5).
- **1988** - PACT process accepted into Environmental Protection Agency (EPA) Superfund Technology Evaluation (SITE) program.
- **1989** - Construction of PACT-6 completed for EPA SITE program.
- **1989-1990** - PACT-8 constructed for Moser-Glaser & Co. and installed in Switzerland.
- **1989-1991** - PACT-6 shakedown tests, SITE demonstrations completed successfully.
- **1992** - Treatability testing for Army in the PACT-1.5, at Retech.
- **1993** - First PACT-2 portable system; three PACT-8 contracts: Lockheed Martin (Idaho) for treatment of transuranic waste; Munster (Germany) for treating chemical weapon-contaminated soils, and Zwilag (Switzerland) for treatment of low-level nuclear waste.
- **1995-'97** - Shakedown tests for Retech's PACT-2; treatability studies for the Army.
- **1996-'98** - PACT-8 contract for Norfolk Naval Station (for the treatment of shipyard waste), and PACT-8 contract awarded for treating Japanese nuclear power plant waste.

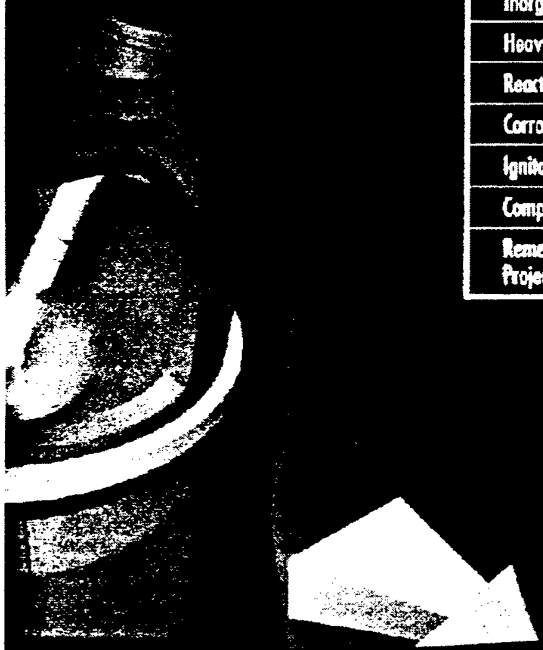

LOCKHEED MARTIN
In a World of
Shrinking Budgets,
How Will You Treat
Your Difficult Waste?


Introducing the World's Most
the
P
Heterogeneous Waste Treatment
Minimal Assay Requirements
Significant Volume Reduction
Superior Final Waste Form
PLASMA ARC
FLEXIBLE FEED SYSTEMS
• Containerized Waste Shredders
• Solid Feeders
• Sludge Feeders
• Liquid Feeders
• Loose Material Feeders
• Waste Blending Systems
• Uses Electr
• High Volum
• Destroys 1
• Patented Pr
Treatment
• Meets All A
and Requir
Nuclear Defense • Military
Industrial • Munic

·satile Waste Treatment Process

CT system

IFUGAL TREATMENT



APPLICATIONS		
Hazardous Wastes	**Radiological Wastes**	**Specialty Wastes**
Organic	Mixed	Medical
Inorganic	Low-Level	Toxic
Heavy Metals	Remote-Handled	Pesticides & Herbicides
Reactive	Transuranic	Illegal Drugs
Corrosive	Resins	Weapons
Ignitable	Contaminated Soils	Munitions
Complex Mixtures	Decommissioning	Chemical Agents
Remediation Projects	Special Nuclear Material	Proprietary Materials and Substances

PLASMA ROCK ™

- Highly Stable Final Waste Form
- Contaminants Bonded into Plasma Rock ™ for more than 10,000 Years
- Meets All Applicable Waste Treatment Standards
- Passes All Applicable Disposal Requirements
- Reusable End Products

System

rgy to Treat Waste

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)rganic Waste Constituents

nsures Complete Waste

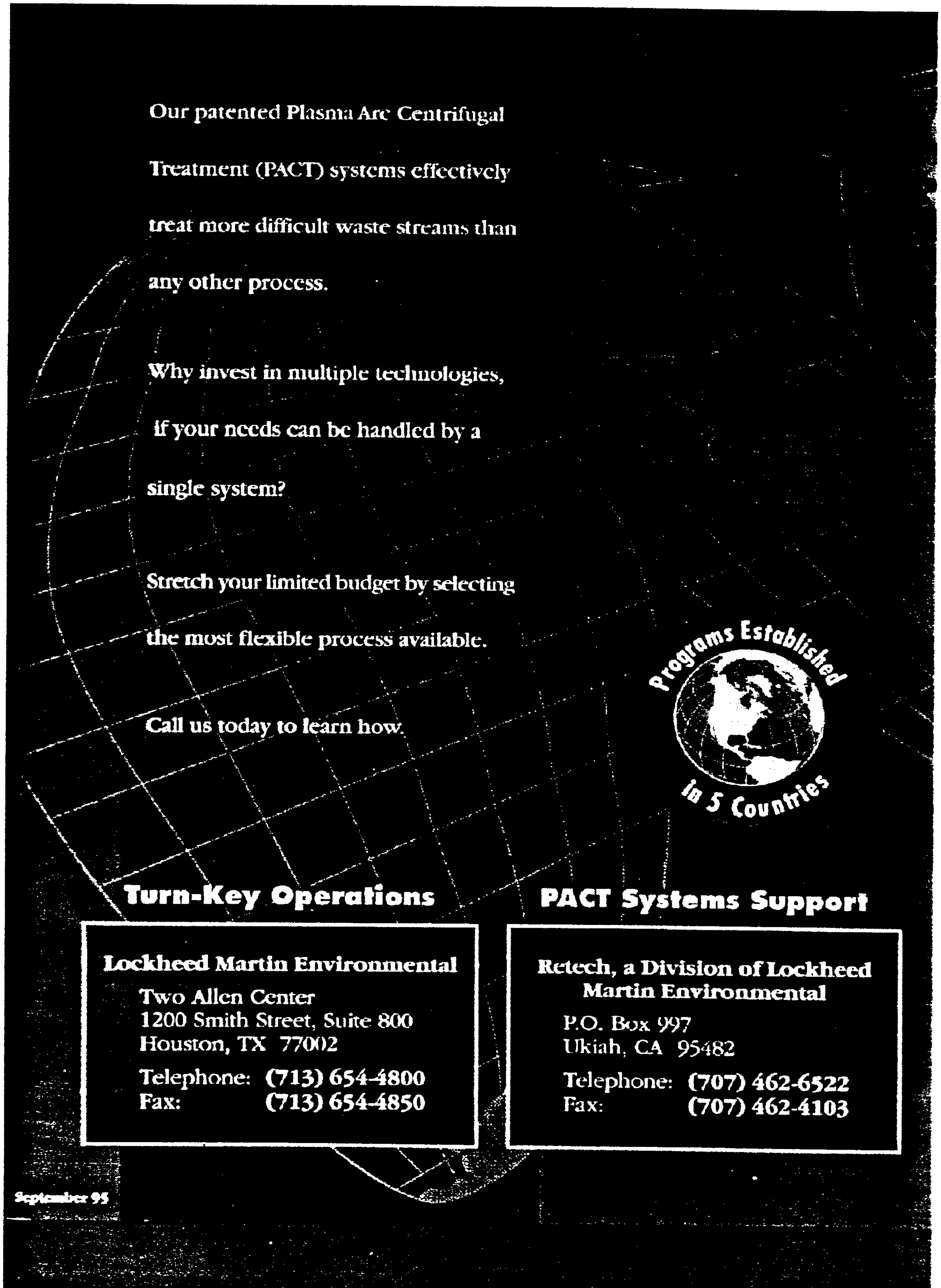
nogenous Output

le Federal/State Regulations

rochemical • Commercial Nuclear

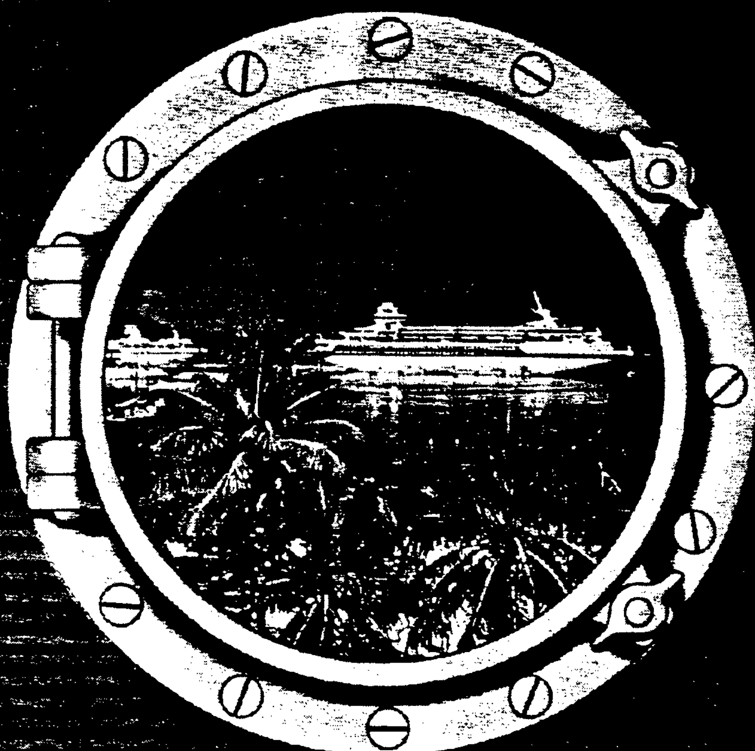
• Medical • Shipboard

LOCKHEED MARTIN


Our patented Plasma Arc Centrifugal Treatment (PACT) systems effectively treat more difficult waste streams than any other process.
Why invest in multiple technologies, if your needs can be handled by a single system?
Stretch your limited budget by selecting the most flexible process available.
Call us today to learn how.
Programs Established in 5 Countries
Turn-Key Operations
Lockheed Martin Environmental
Two Allen Center
1200 Smith Street, Suite 800
Houston, TX 77002
Telephone: (713) 654-4800
Fax: (713) 654-4850
PACT Systems Support
Retech, a Division of Lockheed Martin Environmental
P.O. Box 997
Ukiah, CA 95482
Telephone: (707) 462-6522
Fax: (707) 462-4103
September 95

SCANSHIP ENGINEERING as

Shipboard Waste Treatment Systems



Scanship Environmental Clean Ship Concept

SCANSHIP

Profile 1998 - 2000

SCANSHIP ENGINEERING a.s

SCANSHIP ENGINEERING a.s is a company specialised in providing the cruise industry with advanced Shipboard Waste Treatment Systems.

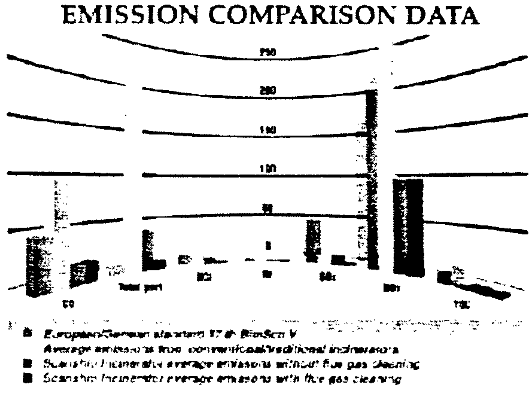
Designed around the size of the cruise liner, the ship's operational area, the existing and forthcoming international and local environmental regulations, the new **Scanship Environmental Clean Ship Concept** is a total Waste Management Plan under which all types of garbage, mixed or sorted, are fed into the system.

The system uses an innovative combination of **Advanced Marine Incinerators** designed and engineered by Scanship Engineering, and **Pulpers/Hydra-Extractors** built by Somat Corporation, a manufacturer of marine waste reduction systems.

The system, even though capable of handling non-sorted garbage, is based on the philosophy of compacting and **recycling** as much waste as possible like aluminium, glass and carton by well proven compactor and crusher units.

The automatic ash removal system is designed to allow a closed and safe transportation of ash by vacuum directly into bags to be brought onshore. The automatic ash removal system enables the incinerator plant to be in operation 24 hours/day without any cooling down periods prior to de-ashing.

EMISSION COMPARISON DATA



The Marine Incinerator is designed with the very latest technology in multi-chamber, semi-pyrolytic process, which provides, as standard, **flue gas emissions** well within IMO-Marpol latest regulations for future emissions.

Scanship Incinerators are even capable of meeting the stringent land-based regulation, Europe's 17th BimSch V, by offering a complete **Flue Gas Cleaning System** including a waste water treatment plant and heat recovery from flue gas. (See emission table).

Our service commitments are professionally handled by our **Scanship - Somat Service Partner Team**; project management, planning and scheduling, cost estimations, quality assurance and procurement.

Cost efficiency is of vital importance in order to be competitive. Being able to deliver the right product with the right quality at the agreed time and price, is our main target for success.

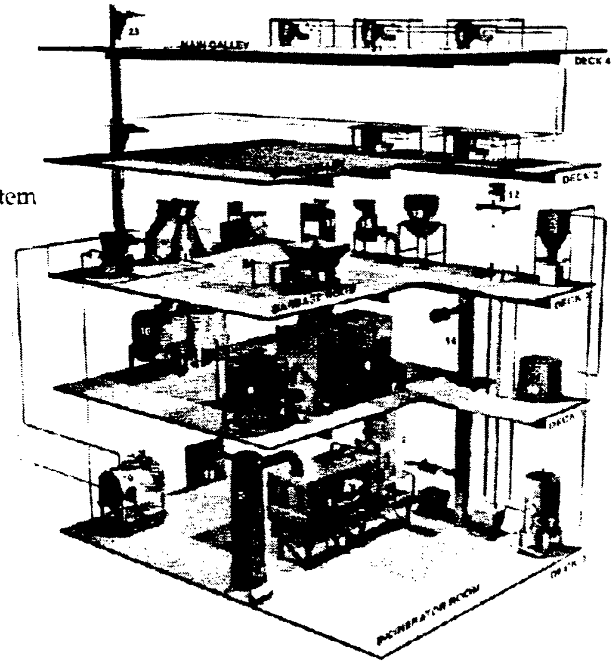
We are in business to avoid unnecessary expenses for our customers in the cruise fleet world wide. We believe that our customers should look upon their co-operation **Scanship - Somat Service Partner Team** not as an expenditure, but as an investment for the future.

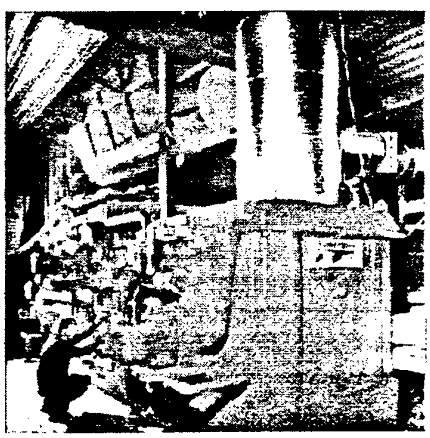
Yours Sincerely
SCANSHIP ENGINEERING A.S

Torkjell Flatland
President

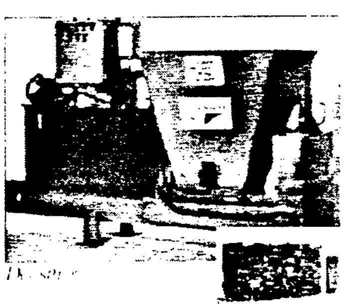
Cruise Vessel Waste Treatment Concept

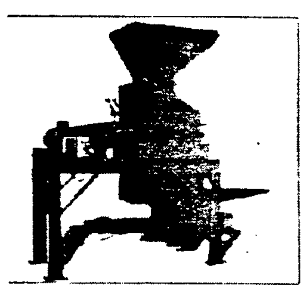
1. Incinerator (600-1600 kW)
2. Incinerator feeding system
3. Flue gas economizer/boiler
4. Waste storage silo
5. Main shredder
6. Bio - dryer
7. Sludge oil tank
8. Gravity separator for ash vacuum system
9. Fall chamber for ash vacuum system
10. Suction unit for ash vacuum system
11. Incinerator control panel
12. Ash container lifting arrangement
13. Ash packing system
14. Ash discharge chute w/valves
15. Glass crusher
16. Densifier
17. Compactor (Bale press)
18. Pulp storage tank
19. Economizer tank
20. Hydra extractor
21. Medium size decentralised pulper
22. Big size centralised pulper
23. Feeding chute
24. Sorting table




Standby Incinerator (1150 kW)

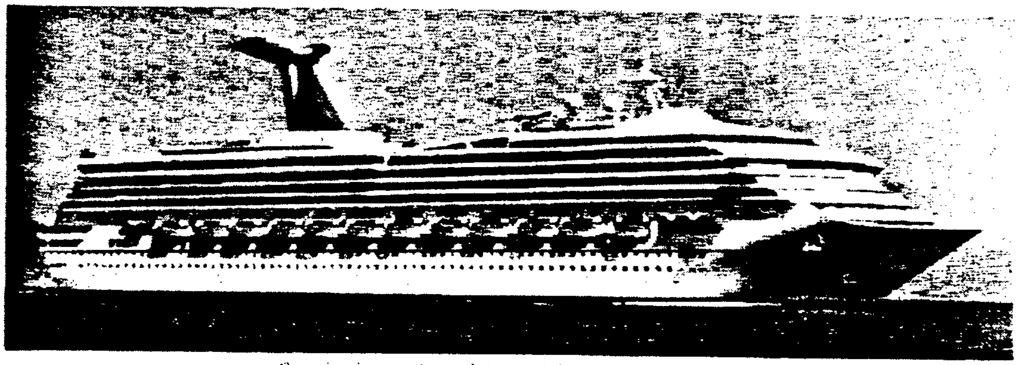
Each component tailor-made for marine use, has been developed through more than 15 years of exclusive experience in the marketing, engineering and manufacturing of Shipboard Waste Treatment Systems. An effective alternative to the installation of an incinerator, can be our big-size high-capacity PULPERS tailor made to handle all wet and dry pulpable waste daily generated onboard. The sterilized and odourless semi-dry pulp from the associated HYDRA EXTRACTORS, is reduced by more than 80% of the original waste volume. The semi-dry pulp can be stored for delivery ashore or discharged into the sea as a slurry mixed with sea water. The PULPERS automatically separate non pulpables, like glass/tins and silverware, routing them to a recessed area for manual periodic removal.


Densifier


Glass Crusher


Centralised Heavy Duty Pulper

Product Range



Seamship Incinerator and Somat Pulper Plant onboard the Mega ship M/S Carnival Destiny

INCINERATOR

Type	Thermal Capacity	Incinerator Capacity (kg/hr 15MJ/kg)	Dimensions A x B x C	Weights (kg)
SE-600	600 kW	126 kg/hr	6100 x 1750 x 2070	18 000
SE-800	800 kW	169 kg/hr	6100 x 1750 x 2070	18 000
SE-1000	1000 kW	211 kg/hr	7240 x 1750 x 2310	20 000
SE-1150	1150 kW	243 kg/hr	7240 x 1750 x 2310	20 000
SE-1400	1400 kW	296 kg/hr	7610 x 1750 x 2510	21 000
SE-1600	1600 kW	339 kg/hr	7610 x 1750 x 2510	21 000

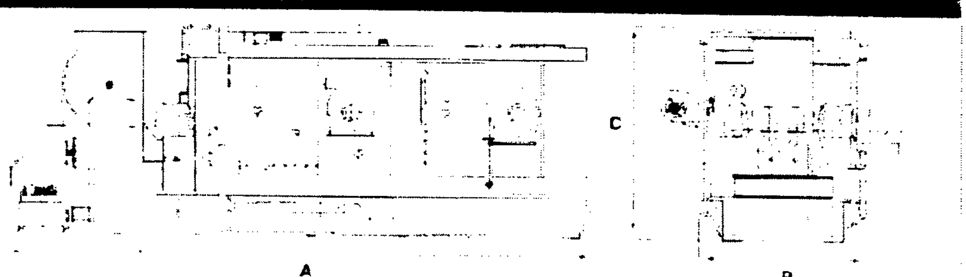
SOMAT PULPERS

Model No	Motor Drive	Capacity (Pounds per Hour/Kgs per Hour)
HE-6S-3-CS	3 horsepower/2.2 kW	2000/810
HE-9S-CS	5 horsepower/3.7 kW	6000/2700
HE-9TS-CS	10 horsepower/7.5 kW	8000/3600
HE-91PS-CS	15 horsepower/11 kW	1000/4500

SOMAT HYDRA-EXTRACTORS

Model No	Motor Drive	Capacity (Pounds per Hour/Kgs per Hour)
SP-50AS-CS	5 horsepower/3.7 kW	1150/520
SP-75S-CS	7.5 horsepower/5.6 kW	1500/680
SP-100S-CS	10 horsepower/7.5 kW	1655/750
SP-150S-CS	15 horsepower/11.2 kW	3000/1360
SP-250S-CS	25 horsepower/18.6 kW	4300/1905
SP-400S-CS	40 horsepower/29.8 kW	6000/2720
D-3-CS	3 horsepower/2.2 kW	200/90
D-5-CS	5 horsepower/3.7 kW	450/205
D-10-CS	10 horsepower/7.5 kW	700/315
D-46-CS	46 horsepower/34 W	2200-5500/1000-2500

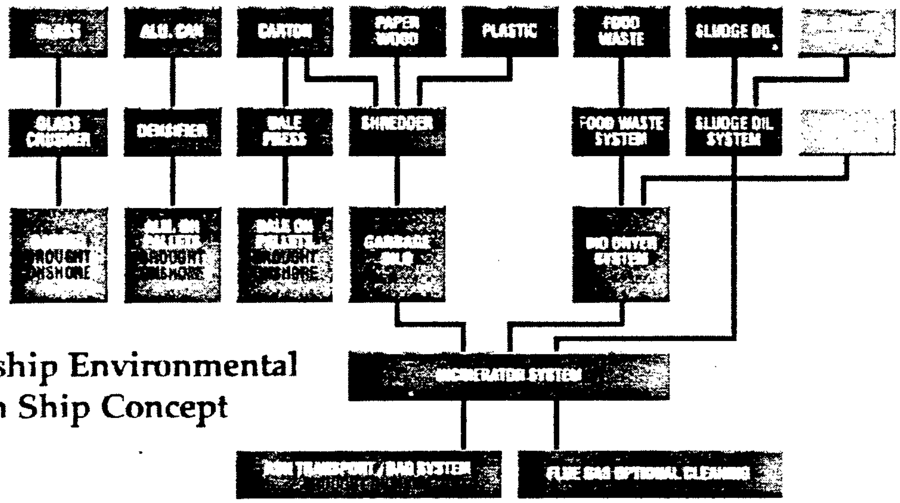
INCINERATOR DIMENSIONS



Scanship - Somat Service Partner

Our service commitments are professionally handled by our Scanship - Somat Service Partner Team. Our service team has more than fifteen years of experience in maintenance and overhaul of Waste Treatment Systems on board cruise ships word-wide.

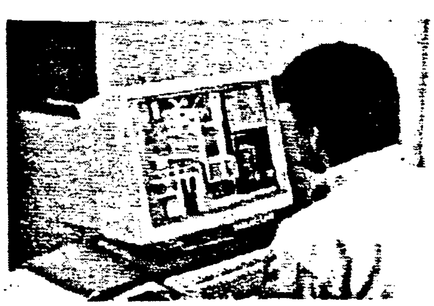
Among other things, our serviceteam uses an advanced flue gas analyser for process diagnostic and process documentation. We have a unique capability and know-how, working with all types of Waste Treatment Systems.



Scanship Environmental Clean Ship Concept

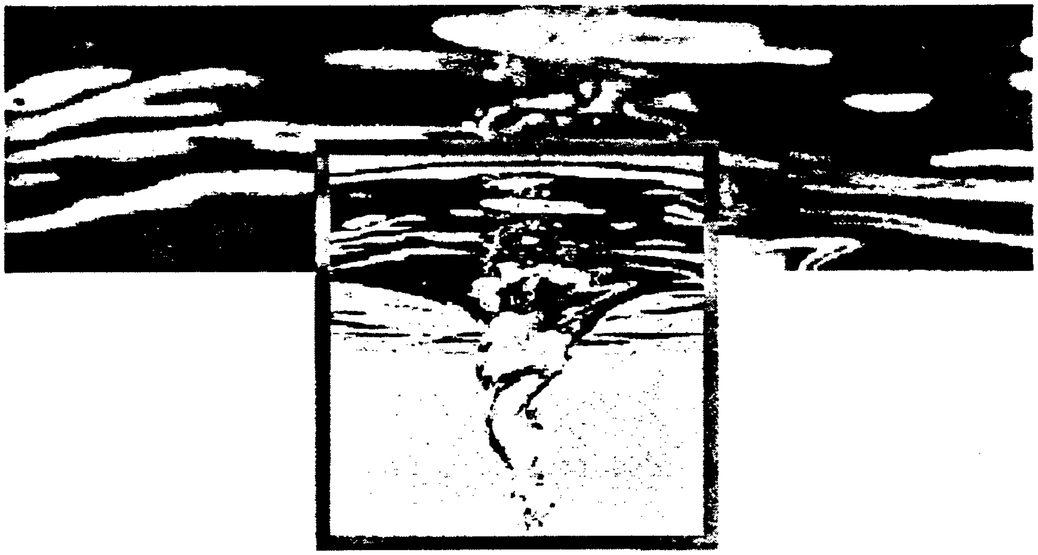
The concept contains the following equipment:

- Food waste marine medium/big size Scanship/Somat **Pulpers**
- High capacity **Hydra-Extactors** with automatic cleaning and chemical dosing system
- Food waste slurry **Economizer/Balancing tank**
- Semi-dry pulp **Storage Tank** w/ejector or screw conveyor discharge system
- **Main Shredder** for mixed or sorted garbage
- **Waste Storage Silos** for automatic incinerator feeding
- **Advanced Marine Incinerator** with continuous automatic ash discharge system
- Automatic **Ash Bagging System** by vacuum
- **Bio-Dryer** for pre-drying of food waste and sewage (optional)
- Glass/tins/carton **Compactors and Shredders**
- **Flue Gas Cleaning System** incl. waste water treatment plant (optional)
- Heat recovery from flue gas by **economizer/ boiler** (optional)



The Engineering Department has a wide experience in performing all type of repairs and modification work on Waste Treatment Systems on board cruise ships.
*We can give engineering support alone, or as part of a certified **Scanship - Somat Service Partner** service team - around the clock, 365 days a year.*
Now, also available program set-up/troubleshooting per satellite directly from Scanship Engineering department to ships world wide.

- *immediate response reduces down time*
- *no travel expenses*

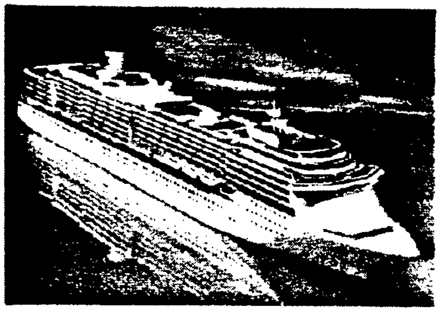


TAIFUN FOOD WASTE MANAGEMENT SYSTEM

FOR MARINE GALLEYS

TAIFUN FOOD MANAGEMENT

FOR MARINE GALLEYS



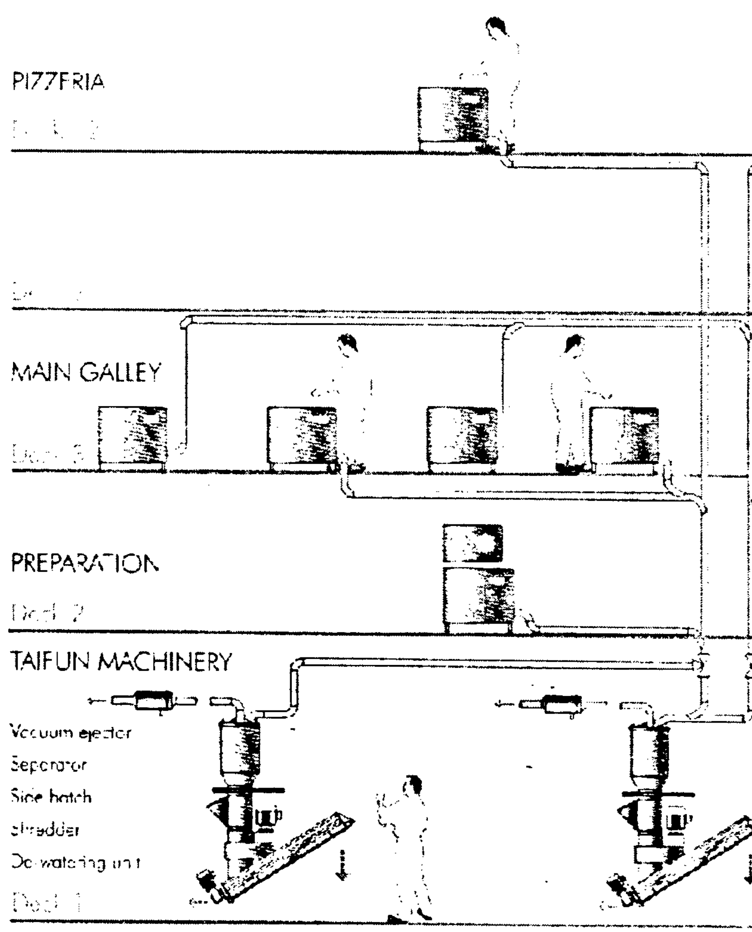
Costa Atlantica, Kvaerner Masa-Yards, NB 498. The first new ship in the world to be equipped with the modern Taifun Food Waste Management System.

RELIABLE OPERATION

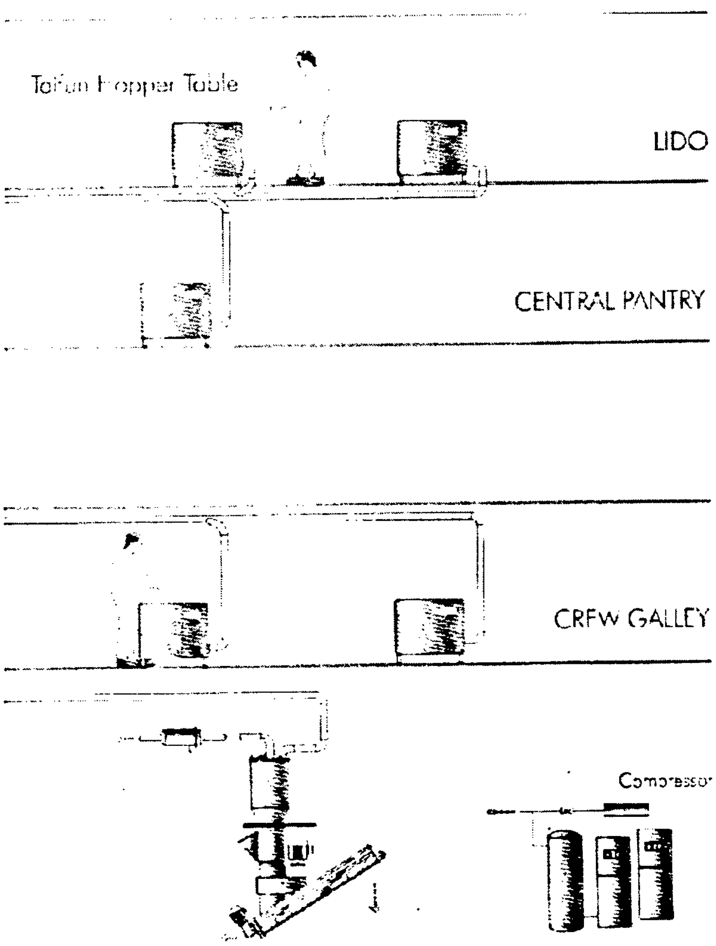
- No crusher required for standard hoppers - safe operation
- Programmable suction sequence.
- Can be run by a timer - no idling
- No garbage bags to be lifted/transported
- New possibilities of galley/pantry design - improved ergonomics and efficiency
- Low water consumption
- Bio waste is de-watered - can be composted.

MORE HYGIENE

- Fulfils today's requirements and demands
- No cross contamination between clean and soiled operations
- No slurry water - no stench.
- Automatic washing system



WASTE SYSTEM



SIMPLE INSTALLATION

- Single pipeline - 50% less piping and 50% lower weight
- Easy pipework planning - less engineering hours.
- Minimal installation restrictions.
- Pipeline can be installed both horizontally and vertically.
- Only low voltage supply in galley areas.

EASY MAINTENANCE

- Simple technical design.
- Practically maintenance free.
- Fewer moving parts.
- All components made of stainless steel
- Modular components, replace from stock - repair at work shop